

Chapter 5: Great Lakes

Wisconsin's 1,017 miles of Great Lakes shoreline provide a vast reservoir of fresh water and much of the special character of the state. Rugged Great Lakes bluffs provide exceptional recreational opportunities; commercial fishing and shipping; and a host of additional aesthetic, ecological, biological and economic values. About a third of our state's 11 million acres of land and about 10,122 river miles drain to Lakes Superior and Michigan. Along this shoreline, however, resides the highest density urban development and most of the state's industry.

Wisconsin has long recognized the value of its unique resources and has established criteria to help protect waters draining to the Great Lakes. In partnership with other state, national and international efforts Wisconsin has committed significant resources to help protect and restore the water quality of all the Great Lakes. In 2004, Governor Doyle made a commitment to the Great Lakes by establishing the Office of the Great Lakes within the WDNR. This office will provide targeted resources to support the complex resource work needed to protect, restore and maintain the quality and quantity of water, habitat and aquatic life that is integral to our state's prosperity and culture.

Lake Michigan

Lake Michigan, the second largest of the Great Lakes, covers 22,300 square miles and has a retention time of 99 years. It is the only Great Lake entirely within the borders of the United States. Lake Michigan is an important national resource supplying drinking water for 10 million people, providing important sport and recreational fishing opportunities and valuable recreational uses. It has also experienced profound changes in its aquatic ecosystem over the last 140 years and is threatened by toxic pollutants that bioaccumulate in the food chain and persist in the environment. The



Lake Michigan ecosystem is stressed through the loss of habitat, declines in biological diversity, the presence and spread of multiple aquatic and terrestrial invasive species, and the presence of persistent bioaccumulating toxic substances, as well as excess sediment and nutrients.

Lake Superior

Lake Superior provides a vast resource of freshwater covering 31,700 square miles. It is the largest freshwater lake in the world by surface area -- its size could hold the water present in all the other Great

Lakes along with three additional Lake Eries. Historically, Lake Superior has not experienced the same level of development, urbanization and pollution as the other Great Lakes. And, while this is cleanest and healthiest of the Great Lakes, toxic bioaccumulating substances are present in its food chain, as they are ubiquitous in the environment. These substances can be transported long distances in the atmosphere and end up in the lake. Because of its long retention time (191 years), pollutants entering Lake Superior can remain in the lake for over a century before draining to the lower Great Lakes.

Great Lakes Charter — Annex 2001

The Great Lakes Charter Annex was signed June 18, 2001. The original Great Lakes Charter (1985) set guiding principles for the U.S. governors and Canadian premiers to maintain and strengthen the Great Lakes ecosystem. The Annex contains six directives to guide the governors and premiers toward their goal of an improved Great Lakes region. The Annex calls for developing a new set of binding agreements, focusing on quantity issues; developing a broad-based public participation program; establishing a new decision making standard; a project review under the Water Re-

sources Development Act of 1986 (amended 2000); developing a decision support system that ensures the best available information; and further commitments to implementing and monitoring the Charter and Annex.

The Council of Great Lakes Governors is coordinating the implementation of Annex 2001. A Water Management Working Group has been created to complete this task. Each state and province had representatives appointed to this group by their respective governors and premiers.

Additionally, an advisory committee which was formed to provide an opportunity for public input, will be comprised primarily of regional organizations from industry, environment, utilities, etc.

Wisconsin supports the development of a standard that focuses on real threats to the Great Lakes, while not making it impossible to access lake water in necessary situations. A uniform policy needs to be agreed upon which will put to an end to debates between parties due to the process being unclear or key terms lacking clarity. The goal of the current agreement is to initiate a broad public dialogue during the 2004 summer months. Public input will help the regional leaders determine which course of Great Lakes water quantity management to pursue.

Assessment Summary

Resources were not available to provide updated assessment data for the 2002-04 reporting period. Updated figures will be available in the 2006 report.

During the next few years, several key activities will be needed to meet this reporting goal: resource allocation to review and develop or update where necessary assessment protocols for Great Lakes shoreline. Assessment protocols that need to be updated or developed for Great Lakes shoreline miles include: fish and aquatic life use, recreation, public water supply, and fish consumption. Once these protocols are developed, they can be applied to the resource and documented in the WADRS system.

Great Lakes Ecosystem Restoration

Key Issues

Wisconsin's involvement in addressing key Great Lakes issues demonstrates our commitment to the restoration of these valuable resources. Great Lakes activities can be categorized as:

- **River Restoration/Dam Removal**—Restoring free-flowing streams and providing additional habitat for anadromous fishes. Coupled with dam removal, projects often involve assessment and remediation of contaminated sediments accumulated above the dams.
- **Habitat Restoration**—Improving habitat in tributary streams for spawning and nursery areas and enhancing habitat with a large-scale or landscape level approach.
- **Pollutant Reduction and Prevention**—Reduction of critical pollutants to levels identified in TMDL analyses for the lakes. Sediment remediation, reduction of atmospheric loadings and nonpoint source controls are needed to eliminate fish consumption advisories. Problematic Great Lakes beach issues such as the presence of *Cladophora*, a filamentous algae, and pathogens are the focus of new studies and management actions.
- **Exotic Species**—Prevent and where possible control populations of exotic species from becoming more established in the Great Lakes. These issues are regional to international in scope and must be dealt with at a national level to ensure that consistent across the board measures are employed for the management of exotic species.

Identification of these key areas has allowed local projects to move forward. However, some particularly difficult issues, such as regional atmospheric deposition of mercury, require coordination of regional solutions from U.S. EPA and other national partners.

Great Lakes Projects

Many Great Lakes projects are implemented through the Great Lakes Protection Fund, the Coastal Zone Management Program, the Lake Superior Binational Program and Lakewide Management Plan (LaMP), and the Lake Michigan LaMP. The completion of the LaMPs for both Lakes Superior and Michigan has accelerated the development of implementation strategies. Interagency cooperation and commitment of the LaMP workgroups have resulted in moving forward with many projects designed to restore or protect the beneficial uses of the Great Lakes ecosystem as outlined in the plans. Likewise, work to alleviate problems identified in Remedial Action Plans is also underway for the state's five areas of concern at Duluth/Superior; Marinette, WI/ Menominee, MI; Green Bay; Sheboygan; and Milwaukee. On a two-year basis, either through the State of the Great Lakes Ecosystem Conference (SOLEC) process or the International Joint Commission (IJC) biennial meeting, the governments should provide updates on Great Lakes Project implementation through LaMP or RAP reporting.

Cladophora blooms on Lake Michigan Coast

Cladophora, a filamentous green algae, has increased its presence on Wisconsin Lake Michigan beaches, as well as Lake Ontario and Lake Erie beaches in other states. *Cladophora* grow attached to hard substrate on the nearshore lake bottom, but break off during storm events or summer "die off", washing onto beaches and where they decay. In some beach locations, windrows of decaying algae produce noxious odors and are potential incubators for harmful bacteria.

Cladophora is a native species that was previously seen at nuisance levels in the 1960's in the Great Lakes due to high phosphorus inputs. Phosphorus loads to Great Lakes tributaries declined in the 1970's due to tighter controls on point sources and a ban on phosphorus in laundry detergents and other restrictions.

Causes of the increased presence of *Cladophora* are not well understood; however increased water clarity, nutrient availability, and water temperature, combined with lower lake levels are key factors.

The presence of zebra mussels in Lake Michigan has dramatically increased water clarity, providing deeper light penetration and expanding the suitable range for *Cladophora*. In addition, zebra mussels concentrate available phosphorus in the nearshore through the deposition of feces, which may be fertilizing *Cladophora* beds.

Research by UW-Milwaukee indicates phosphorus loads to the Milwaukee River, for example, have increased in recent years. Other Lake Michigan tributaries are likely experiencing similar trends. Monitoring major tributaries by WDNR and the UW-Milwaukee will investigate possible changes in phosphorus loads.

Lower lake levels may also contribute to the problem by increasing areas suitable for *Cladophora* growth. Surveys of the Lake Michigan coastline are also scheduled to better understand the distribution of *Cladophora* along the coast.

Funding Sources

Projects designed to improve and enhance the resources of the Great Lakes and the goals and objectives of the RAPs, LaMPs and Binational Program are supported by federal grants from U.S. Environmental Protection Agency, the Army Corps of Engineers, the Coastal Management Program and the Wisconsin share of the Great Lakes Protection Fund. These funds are provided to individuals, universities, local and state government and groups to implement the projects that further the goals of preserving and enhancing the Great Lakes. A new source of funding will become available to states in the coming years, the Great Lakes Legacy Fund, which will provide resources for contaminated sediment and other types of remediation work in the Great Lakes.

Project Descriptions

River Restoration/Removal of Dams

Several dam removal projects on the Milwaukee and Sheboygan Rivers, tributaries to Lake Michigan, have experienced substantial progress in the past two years. These projects have included habitat improvement goals to reestablish fish and wildlife. Additional dam removal projects are in the planning or implementation stages within the basin (see the 2002 Water Quality Report to Congress). In the Lake Superior Basin, removal of the Orienta dam on the Iron River has been completed.

Habitat Restoration

In the Lake Michigan Basin, projects are underway for aquatic life and habitat enhancement in Green Bay through the Cat Island Chain Restoration Project and the Green Bay Marina Project.

Several projects are also on-going in the Lake Superior Basin. The Northern Pike habitat restoration project involves installing buffer strips on low order streams. Eighty-three (83) acres of buffers, or 12 miles of stream buffer, have

been installed along parts of Trout Creek, Fish Creek, and the upper reaches of the Suamico and Little Suamico River watershed. This joint effort involves Outagamie and Brown Counties and the Oneida Nation Reservation.

The Manitowoc Soil and Water Conservation Department (federal agency) and the Kewaunee County Land Conservation Department (local) are reducing sediment and phosphorus loading to the West Twin River and East Twin River watersheds through buffers and wetland restoration.

Special efforts are underway to restore Lake Sturgeon and Lake Superior brook trout populations. Buffer strips were installed for water quality and habitat improvement along waterways. In Brown County along Baird Creek approximately 27 acres, encompassing 3.5 miles of stream buffers, were installed between 2002-2003. These efforts will reduce nutrient loading to the stream by 69 pounds of phosphorus, 38 pounds of nitrogen and 71 tons of sediment per year.

Efforts are underway to restore lost wetlands in several basins adjacent to the Great Lakes. Approximately 25 acres of wetlands were restored and spawning habitat was improved in a project in the City of Mequon along Trinity Creek, a tributary to the Milwaukee River. The wetland restoration will provide spawning area for northern pike as they move upstream on the river. The restored area also helps abate flooding along the creek and provides a natural recreational area.

In the Lake Superior basin the WDNR is working with several other agencies and the public to pursue a watershed-based strategy to reduce peak flows that contribute to streambank erosion and habitat degradation in tributaries. Among the pilot projects underway, WDNR, U.S. Geological Survey (USGS) and UW-Madison Engineering School are using submerged vanes to stabilize erosion on steep sandy slopes on North Fish Creek, a tributary to Chequamegon Bay. Increased runoff from agriculture and logging practices on areas with clay soils has increased flood magnitudes and the erosion transport of the streams. The creek's sediment load largely originates from erosion on 17 large bluffs. North Fish Creek contains important recreational fisheries limited by the loss of aquatic habitat from deposition of sediment on spawning beds. Currently submerged vanes are installed in the streambed at two sites on Fish Creek in Ashland. These vanes are designed to divert the water's energy forces away from the eroding bluff thus reducing sedimentation to the stream. Controlling erosion will improve the streambed, enhancing spawning of migratory fish from Lake Superior. In 2004, a third site will be installed. Available data show the stream is moving away from the eroding bluff, which in turn is decreasing sediment load to the stream.

WDNR is pursuing the use of the Conservation Research Program's continuous buffer sign-ups for tributary streambanks to help restore and protect important spawning areas for Great Lakes fish. The use of buffer strips along waterways helps improve water quality by trapping sediments and nutrients, as well as providing habitat for aquatic and terrestrial species. WDNR is working with counties, NRCS and other groups to combine resources and information to work with farmers and landowners to have more buffer strips installed, especially in critical Great Lakes watersheds.

Pollutant Reduction and Prevention

Sediment Remediation

Historic discharges have left a legacy of contaminants that have restricted human consumption of Great Lakes fish. Sediment remediation involves big projects with expensive solutions but as new ideas and approaches are being advanced and through collective public-private efforts, progress is being made. Projects include Hayton Millpond, Newton Creek and Hog Island Inlet, and the Fox River (see Contaminated Sediment Projects, Chapter 3).

Mercury and Other Persistent Chemical Reduction

Reduction of mercury and other persistent chemicals from the environment through proper disposal and education is a high priority in improving the water quality of lakes and streams. These efforts have included Agricultural Clean Sweeps in cooperation with the Department of Agriculture, Trade and Consumer Protection (DATCP) to remove hundreds of pounds of agricultural chemicals from the environment in the Great Lakes Counties by offering farmers a no cost option for proper disposal of their unused farm chemicals. Additional grants were offered to counties in the Great Lakes basins through the Great Lakes Protection Fund.

In 2002, over 279,714 pounds of chemicals were collected in 36 counties participating in clean

sweeps (21 counties were in the Great Lakes Basin). In 2003, a total of 36 counties participated in the agricultural clean sweep, 16 of these counties are in the great lakes basins and collected 282,746 pounds of chemicals. Similar programs for household hazardous waste are also offered around the state. In particular, a grant offered a mobile household and agricultural waste clean sweep program in the Lake Superior basin. This program covers a four county area and provided a mobile service that traveled to various communities to pick up chemical waste. On-going efforts by local governments, school districts and counties have increased the awareness of the impact of various household products, chemicals, and open burning have on the environment.

Mercury Reduction, Focus: Lake Superior

WDNR, UW – Water Resources Institute, and Lake Superior State University (Sault Ste. Marie, MI) continue to work on a comprehensive mercury study of Lake Superior. With financial support from USEPA and the Wisconsin Sea Grant Institute, the study is revealing the biogeochemical cycle of mercury in the open waters of Lake Superior and its tributaries. Water, plankton, and sediments were sampled for total and methyl mercury at sites throughout the lake. Total mercury concentrations were consistently below 1 ng/L throughout the lake. The methyl mercury concentrations were around 5 pg/L at both the surface and deep waters. Tentative results suggest that the sediments of Lake Superior are not a source of biogenic methyl mercury production. Surprisingly, however, methyl mercury has been measured in wet deposition around the lake. Future efforts will be made to evaluate the dynamics of methyl mercury inputs from tributaries to the lake and interactions at the mixing zones with the near-shore waters.

Exotic Species

Projects funded through the Great Lakes Program to control exotic species from spreading to uninfested waterbodies have included educational outreach projects to inform the public how their actions impact the spread of exotic species. These projects, aimed at changing boaters' behavior to clean their boats before leaving the launching sites, include Public Service Announcements (PSA) broadcast during sporting events, a special publication in the Natural Resources Magazine on the impacts of exotics on our fisheries, tourism and local economy, and a video to be used by sporting groups, lake associations and others at meetings and special events. Specific control structures were also funded, like the construction of lamprey barriers on the Brule River in the Lake Superior Basin.

Coastal Zone Program

Wisconsin is required to implement a nonpoint source management program under Section 6217 of the 1990 Coastal Zone Act Reauthorization Amendments. The program requires enforceable policies to regulate compliance with USEPA for six categories of nonpoint source activities including agriculture, urban, forestry, wetlands, hydromodifications and marinas. Specific management measures involve programs administered by WDNR; DATCP, the Department of Commerce; and the Department of Transportation. The management area includes all the Great Lakes drainage area in Wisconsin except the Wolf and Upper Fox Basins upstream of the outlet of Lake Winnebago. Wisconsin has many activities in this area, including 22 priority watershed projects. Nearly all of the urban areas will come under U.S. EPA's recently promulgated Storm Water Phase 2

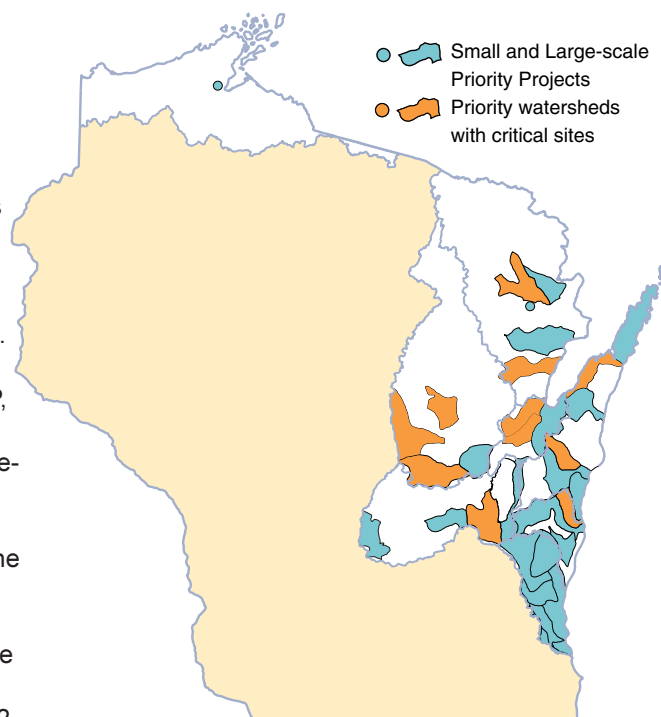


Figure 28. PWS projects in Great Lakes Basin

regulations. Forestry activities are managed through use of best management practices contained in the WDNR published manual. Wetland protection and regulation of hydromodifications are statewide programs.

Lake Michigan Lakewide Area Management Plan (LaMP)

The Lake Michigan Lakewide Management Plan (LaMP), updated in 2004, outlines a vision, goals and ecosystem objectives for Lake Michigan. The following are broad goals identified in the report:

- All persons can eat any fish.
- All persons can all drink the water.
- All persons can swim in the water.
- All habitats are healthy, naturally diverse and sufficient to sustain viable biological communities.
- Public access to open space, shoreline and natural areas is abundant and provides enhanced opportunities for human interaction with the Lake Michigan ecosystem.
- Land use, recreation and economic activities are sustainable and support a healthy ecosystem.

For each of these goals, LaMP 2000 includes indicators and monitoring recommendations for lake ecosystem health, status, and stressor sources and loads, and recommends actions or “next steps” for remediation, restoration or other necessary work.

Lake Michigan LaMP Update

Wisconsin has worked with USEPA, other states, and other interested parties to revise the LaMP. Updates include a standardized procedure for reviewing the list of ‘critical pollutants’ included in LaMP 2000. Tools have also been developed to better identify habitat data and land use management resources. Tools include information regarding funding sources for best management practices, brownfields redevelopment, prevention and control of air pollution, water restoration work, and aquatic habitat conservation and restoration.

In addition, the LaMP updates identify specific actions that both support the goals of the LaMP and that are consistent with the Great Lakes Strategy, an overall framework with goals and objectives for management of the Great Lakes. For example, a proposed action in the current draft indicates that a TMDL Strategy will be developed for Lake Michigan, which is consistent with the USEPA’s Great Lakes Strategy.

Issues of major concern include the level of contamination in fish and the ultimate goal of removal of consumption advisories. Because advisories for mercury, for example, are in place largely due to atmospheric deposition, meeting this goal would require a national and international effort. Also, more knowledge, funding and additional resources are needed to fully address contaminated sediments, program coordination, ecological habitat and pathogen monitoring.

Lake Superior LaMP and Bi-National Program

WDNR is one of several partner agencies in the Binational Program to Protect and Restore the Lake Superior Basin (“Binational Program”). This program was formed in 1991 by agreement signed by the governors of Wisconsin, Minnesota, Michigan, and by representatives of the USEPA, Environment Canada and the Province of Ontario. Its key features include a zero discharge demonstration program for Lake Superior and a broad program of coordinated ecosystem management. The Binational Program is often held up as a model of inter-jurisdictional resource management.

The Lake Superior Lakewide Management Plan (LaMP) reports progress on the Lake Superior Binational Program as well as the Great Lakes Water Quality Agreement. Stages 1 and 2 of the Lakewide Management Plan for Lake Superior came out in 1995 and 1999 respectively. These stages focused primarily on chemical pollutants. In 2000, a more comprehensive LaMP was developed, which includes strategies for pollutant reductions as well as strategies addressing issues of habitat, aquatic and terrestrial communities, human health, and sustainability. Progress reports and plan updates are produced every two years. LaMP 2002 and LaMP 2004 are available on the EPA Great Lakes National Program Office website.

The Wisconsin DNR is working with Lake Superior basin communities and citizen groups on watershed and habitat protection efforts and community-based pollution prevention. Another major implementation push in Wisconsin is to pursue resources for contaminated sediment remediation. The St. Louis River and estuary is the largest U.S. tributary to Lake Superior, and the only Area of Concern in Wisconsin waters of Lake Superior. Many of the implementation projects underway in Wisconsin serve to meet the goals of the St. Louis River Remedial Action Plan as well as the Lakewide Management Plan for Lake Superior.

Zero Discharge Demonstration Program

The Lake Superior Zero Discharge Demonstration Program is unique in the Great Lakes. The goal is to eliminate sources of the “nasty nine” critical pollutants in the Lake Superior basin by the year 2020. The key to zero discharge and zero emission is pollution prevention. This is an experimental program to see if we can find ways to prevent these chemicals from being used in processes or products to prevent their release in the Lake Superior Basin. The nine targeted pollutants are mercury, PCBs, dioxin, hexachlorobenzene, octochlorostyrene, aldrin/dieldrin, chlordane, DDT/DDE, and toxaphene. These pollutants are toxic, bioaccumulative, and persist in the environment.

Why zero discharge for Lake Superior?

Lake Superior is vulnerable to toxic substances. Water stays in the Lake for over 150 years, on average. Although it is the cleanest of the Great Lakes, toxic pollutants accumulate in Lake Superior’s fish and wildlife. People feel strongly about protecting the Lake Superior basin, one of the world’s great places. The idea of a Lake Superior “zero discharge” demonstration came from public support in the 1980s. The 1991 Binational Program agreement stresses voluntary pollution prevention, but acknowledges that enhanced controls and regulations may be necessary.

Community Pollution Prevention

Many communities around the basin are working on ways to prevent pollutants, particularly mercury, from getting into the Lake Superior environment. Consumer and commercial products can be a significant source of mercury. Mercury-containing products can include thermometers, switches, dental amalgams, thermostats, button batteries, and fluorescent lamps. Industrial raw materials can also contain unwanted mercury. The City of Superior, Wisconsin has become a regional leader in community mercury reduction, working with Ashland, the Red Cliff Band of Lake Superior Chippewa, and with other Lake Superior communities in the U.S. and Canada. Key recent pollution prevention projects include the following

Superior set up a fluorescent bulb recycling program where local hardware stores provide collection facilities and local industries (Murphy Oil USA and Superior Water Light and Power) provide funds for bulb recycling.

The Cities of Superior and Ashland set up a program with auto dealers to replace mercury switches in vehicles before they leave the lots. The auto dealers display posters and flyers advertising their participation.

Superior and one of its major industries, the Murphy Oil refinery, are developing a plan to eliminate the use of mercury and PCB containing equipment at the refinery. The project includes development of a purchasing policy and project outreach that can be used by other industrial facilities. The Northwest Wisconsin Mercury Free Schools program has reached 85 schools. City of Superior staff presents programs to all age school groups. Schools pledge to remove mercury products and elemental mercury. The program includes technical assistance and facility audits. Northwest Wisconsin Regional Planning Commission collects the mercury devices and other hazardous waste. Thousands of mercury items and hundreds of pounds of mercury have been collected through this program.

City of Superior offered Dental Office Best Management Practices workshops to all Douglas County dentists. City of Superior and City of Ashland pollution prevention project staff have now visited most of the dental offices in the basin in Wisconsin to present training in best management practices.

Wisconsin agencies and individuals developed and produced poster displays on Lake Superior

issues including mercury and burn barrels. The posters were used at county fair displays during the summer of 2002 and are placed in several locations including the Northern Great Lakes Visitor Center.

The Red Cliff Band of Lake Superior Chippewa Reservation has hired a mercury elimination coordinator to work with the community on mercury reduction and burn barrel projects. A June 2003 community workshop kicked off the project, which includes a radio show that combines music and environmental messages on the Red Cliff radio station.

The Town of Delta in Bayfield County, Wisconsin investigated mercury levels in soil at their abandoned town dump and hired a contractor to develop an erosion control plan at the site, which sits on a tributary to Lake Superior.

In 2002 Ashland, Wisconsin passed an ordinance banning the sale of products containing over 50 mg of mercury (with the exception of dental amalgam). The ban does not apply to fluorescent lights since they contain less than 50 mg mercury. Ashland's ordinance also requires mercury containing devices to be removed from buildings. Superior, WI banned fluorescent lights from landfills in 2002. The city of Ashland and Douglas County had banned the sale of mercury thermometers in 2001.

Hazardous Waste Collections: household, agricultural, small business

In Wisconsin's Lake Superior counties, collections for hazardous waste from households, small businesses, and agricultural operations is conducted through a mobile collection program operated by Northwest Wisconsin Regional Planning Commission. In 2002, the program expanded to provide "milk run" collections for small businesses to make proper disposal of hazardous waste more affordable in this rural area. The community based pollution prevention projects in the basin, including the Northwest Wisconsin Mercury Free Schools, utilize this collection program. The collection program has been funded through federal, state, and county government.

Table 9. Pesticides Collected in WI Lake Superior Counties by Northwest Cleansweep Program

Dates of Collection	Chlordane	DDT	Silvex/ 2-4D/ 2,4,5T	Total Pesticides ¹
Kg. collected (99-03)	39	36	89	8,682

Data from the Northwest Wisconsin Regional Planning Commission compiled by the Wisconsin Department of Natural Resources for Ashland, Bayfield, Douglas and Iron Counties.

Dioxin – A Burning Issue:

Burn barrels or backyard garbage burning is a continuing source of dioxin emissions in the rural Lake Superior basin. This practice produces dioxin that enters the environment and human food sources, posing health risks. Wisconsin Environmental Health Association and Wisconsin Department of Natural Resources produced the *Air Defenders: The Quest for Clean Air*, an educational program about open burning, air quality and asthma for children 10 years and older. The kit includes a CD of an interactive education game, posters, brochures, a WDNR video called *Give Burn Barrels the Boot* and a CD with music lyrics for songs such as *The Burn Barrel Blues*. This material is being used widely throughout the Lake Superior basin. Northwest Wisconsin Regional Planning Commission is developing a burn barrel education video for local officials.

Industry and Economic Changes

Elsewhere in the Lake Superior basin, facility closures in the mining sector resulted in reduced mercury emissions in the basin, but at a large economic cost to the region. Wisconsin has seen the closure of forest product industry facilities in the Lake Superior basin in recent years. Wisconsin's Lake Superior basin is facing growing development pressures as it becomes increasingly an area of second homes and recreational property. Sustainability is an important issue for the economic and environmental health of the Lake Superior region.

Continuing Challenges

Long-range transport of pollutants in the atmosphere

The zero discharge demonstration program focuses on air emissions, water discharges, and the use or formation of the nine critical chemicals within the Lake Superior drainage basin. However, sources outside of the basin greatly affect Lake Superior. Lake Superior with its large surface area receives a relatively high deposition of airborne toxics. Actions on a national and international level have an extremely important role in protecting Lake Superior. Actions on a state-wide basis are also important for protecting Lake Superior.

Contaminated Sediment and Stormwater: Sources of Other Critical Pollutants:

In addition to the nine pollutants included in the Lake Superior Zero Discharge Demonstration Program, the LaMP process identified other critical pollutants for Lake Superior which impair beneficial uses. Although these critical pollutants are not slated for zero discharge, the goal is pollutant reduction so that beneficial uses are restored. Polynuclear Aromatic Hydrocarbons (PAHs) in particular cause multiple impacts in the Lake Superior basin. The presence of these pollutants in contaminated sediment and stormwater runoff is important to the Lake Superior ecosystem because they impact its most biologically productive region.

Lake Superior has a narrow rim. Less than 5 percent of its area is comprised of shallow nearshore area and embayments, which is a lake's most biologically productive area. Most species of Lake Superior fish use the nearshore waters for some critical life stages. Unfortunately, these nearshore and embayments are also the areas most affected by contaminated sediment and stormwater runoff carrying contaminants from industrial and developed areas. Considerable funding is needed to clean up contaminated sites and restore this important aquatic habitat.

In the St. Louis River Area of Concern, WDNR is working with partners to pursue resources for clean up at the Newton Creek / Hog Island inlet site in Superior. In 2003, most of Newton Creek's contaminated sediment and floodplain soils were removed. The ultimate goal is to restore this area of valuable shallow water habitat of Superior Bay (see Chapter 3: Contaminated Sediment).

WDNR, U.S. EPA, and responsible parties continue to investigate the Ashland – Waterfront Superfund site in Ashland, Wisconsin. Groundwater contamination and PAH contaminated sediment in a ten-acre area of the Ashland waterfront result from historical operation of a coal gasification plant. The site includes high concentrations of PAHs in bottom sediments and degraded aquatic habitat off the City of Ashland's Kreher Park in Chequamegon Bay. The contamination originates from the on-land location of a former manufactured gas plant (see Chapter 3: Contaminated Sediment).

The Lake Superior Stormwater Project

In 1993 to 1995, the Lake Superior Binational Program engaged in a project to investigate the importance of stormwater as a pollutant source in the Lake Superior Basin. Most urban storm runoff was delivered to the lake untreated, by way of ditches and storm sewers that flow into the lake or to tributary streams. This project was a partnership of Wisconsin, Minnesota, Michigan, the U.S. Geological Service and U.S. Environmental Protection Agency. The project estimated the amounts of stormwater pollutants entering Lake Superior, developed best-management practices for reducing contaminated runoff from bulk storage piles, conducted an information campaign about stormwater pollution, and assisted communities in stormwater planning. Samples of water from rain and melting snow were taken from streets, rooftops and storm sewers. Heavy metals and PAHs in storm sewers were typically at concentrations exceeding the allowable limits in point source discharges. Total loading of PAHs to the lake from storm sewers in urban areas on the U.S. side of the basin was calculated at 550 kilograms/1213 lbs/year.

In the years following this project, stormwater-permitting requirements have been established by the USEPA for larger communities. The Lake Superior stormwater project helped lay the foundation for stormwater planning and controls in Duluth, Minnesota; Superior, Wisconsin; and Marquette, Michigan. USEPA's next phase of stormwater regulations (Phase II) will extend requirements for erosion control and on-going stormwater management to industries and activities in areas in which one acre of land or more is disturbed. While these new requirements will help the Lake Superior environment, they enhance the need for education. The following projects to address those needs:

- The Village of LaPointe, Wisconsin has a stormwater demonstration project at a commercial development near the Madeline Island waterfront funded by Wisconsin Coastal Management.

- Wisconsin Department of Natural Resources and University of Wisconsin-Lake Superior Research Institute have a watershed education and stormwater outreach project to reach local officials and developers on the reasons for stormwater management to protect Lake Superior watersheds and fisheries (funded by WI Great Lakes Protection Fund).
- Superior, Wisconsin has a stormwater planning and education project. The local schools participate in educational events and have stenciled storm sewer covers with the message "Dump No Waste- Drains to Lake." The City also offers assistance to local homeowners for water management and has set up demonstration rain gardens and rain barrels. Wisconsin Great Lakes Protection Fund and the Great Lakes Commission have funded this work. The City is seeking funding for stormwater retention and treatment basins.

LaMP Habitat Projects in Wisconsin

A number of projects and activities are underway in Wisconsin to implement the ecosystem objectives of the Lake Superior LaMP.

Common tern habitat: In the fall of 2002 a new island was built for common terns -- a Wisconsin endangered species -- in Ashland. The Ashland colony is one of only two common tern nesting colonies in the entire Lake Superior basin. The other colony is located on Interstate Island in the St. Louis River estuary. In 2003 a slight increase in the number of nesting pairs using the new island was noted, with 90 pairs of terns nesting there. Production was one of the highest ever observed with nearly two young fledged per nest.

Iron River Habitat Restoration: In 2001, an abandoned hydropower dam was removed from the Iron River, about 1.5 miles above where it enters Lake Superior. What had been a warm water impoundment was restored to trout stream. The project took years to complete. The original hydropower dam was constructed in 1923 and was destroyed by later floods. In 2001, the remaining barrier was removed from the sandstone outcrop known as Orienta Falls, which old newspaper articles called the most scenic site in Bayfield County. At Orienta Falls, water drops 15 to 20 feet over a distance of 200 feet. Project partners include Xcel Energy (formerly NSP), which contributed about \$500,000 to remove the remains of both dams. The Wisconsin DNR and the Great Lakes Fishery Commission paid for construction of a low-head barrier to keep sea lamprey out of the 56 miles of trout streams in the Iron River watershed. Until a management plan is developed, fish migration from Lake Superior will remain blocked. In the meantime, the river is returning to a more natural state. Below the former dam site, lake-run salmonids are reproducing once again.

Land Management and Stormwater: A project is being implemented in Wisconsin to develop best land management practice guidelines for the Wisconsin portion of the Lake Superior basin to reduce nonpoint pollution and stream damage. The project was funded by the Great Lakes Protection Fund and is being implemented by the Ashland, Bayfield, Douglas and Iron Counties' Land and Water Conservation Departments with assistance from Wisconsin DNR.

Wisconsin Lake Superior Partner Team

The Wisconsin Lake Superior Public Partner Team is a 40-member stakeholder group established in 1998 by the WDNR to advise state government on Lake Superior issues and to work with the state on Binational Program implementation. The group worked on recommendations for Lake Superior special designations for several years and provided recommendations to the DNR in 2002. The Partnership Team, a broad cross section of basin citizens in Wisconsin, including municipal and county elected officials, business and industry, and citizen groups, continues to work on initiatives to promote watershed health in the Wisconsin Lake Superior Basin.

Wisconsin Lake Superior Protection Fund

In 2001 the Wisconsin awarded \$250,000 from the state share of the Great Lakes Protection Fund to 10 basin organizations to reduce mercury, prevent pollution, and support watershed based planning to reduce erosion and tributary degradation. The Lake Superior Partner Team helped establish the priorities for this funding: they set mercury reduction and small planning grants as the priorities for the \$250,000 available for 2001. The Great Lakes Protection Fund is an endowment established by the Great Lakes states. Each year a portion of the earnings returns to each state for environmen-

tal cleanup and protection. Many of the projects discussed in the Lake Superior section of this report have been funded through this program.

Remedial Action Plans for Water Quality Restoration

Wisconsin is responsible for implementing remedial action plans (RAPs) at five Great Lake sites -- four on Lake Michigan and one on Lake Superior (Figure 29). At two of the RAP sites, implementation is a shared responsibility with adjoining states. For the Menominee RAP, Michigan and Wisconsin share responsibility for implementation. For the St. Louis and Duluth/Superior Harbor RAP, both Minnesota and Wisconsin are implementing recommendations that pertain to their authorities.

All of the five RAP sites are in the process of implementing the recommendations contained in the stage I & II planning documents. Actions are being implemented at each of the RAP sites that are aimed at restoring and protecting the designated uses in the Areas of Concern. At all sites work toward restoration of beneficial uses has become incorporated into the routine planning process and regular work activities of the basins in which the AOC is located. This 2004 report highlights three of the five areas of concern: the Lower Green Bay and Fox River, Sheboygan, and St. Louis River/Duluth Superior Harbor. Please see the 2002 report for a more extensive description of all five areas.

Lower Green Bay and Fox River

Description

The Lower Green Bay and Fox River Area of Concern (AOC) consists of the lower 11.2 kilometers of the Fox River below DePere Dam and a 55 square kilometer area of southern Green Bay out to Point au Sable and Long Tail Point. The drainage area encompasses portions of eighteen counties in Wisconsin and 40 watersheds of the Upper Fox River, Wolf River and the Lower Fox River Basins, including the largest inland lakes in Wisconsin -- Lake Winnebago and its pool lakes. While water quality problems and public use restrictions are most severe in the AOC, water resources of the entire basin are affected by runoff pollution from rural and urban areas, municipal and industrial wastewater discharges and degraded habitats.

Eleven use impairments have been documented and two are suspected of being impaired for the Lower Green Bay and Fox River AOC through the Remedial Action Plan (RAP) process. Ecosystem services and human uses such as fishing, boating, swimming, hunting and passive recreation have been impaired. Soil erosion and runoff pollution cause most use impairments from upstream tributaries, persistent bioaccumulative contaminants in river and bay sediments, and habitat losses. Turbid, algae-laden waters degrade aquatic habitats and restrict swimming. Consumption advisories warn against eating mallard ducks and twelve species of fish. Shipping and navigation are impaired by sediment loading from soil erosion and the high cost of dredging and disposing contaminated sediments.

Despite incremental improvements to prevent water pollution, restore habitats, improve public access and further define the causes of impaired uses, none of the problems in the AOC have been completely resolved. Recommendations are being implemented sequentially with the easiest ones having been completed and the more difficult and costly actions yet to be implemented.

Highlights

Community leaders have established additional nonprofit organizations to promote implementation of nonpoint source pollution controls and to determine the most cost-effective actions to meet the nutrient and suspended solids objectives of the RAP. The following are remaining actions to



Figure 29: Wisconsin RAP Sites

be implemented:

- PCB contaminated sediment remediation in 39 miles of the Lower Fox River (see below)
- Nonpoint source abatement/pollution and prevention including comprehensive watershed projects to abate runoff pollution, TMDLs for phosphorus and suspended solids in the Fox-Wolf basin, and riparian buffers throughout the Fox-Wolf basin are ongoing.
- Habitat protection and restoration that involve restoring an eroded chain of barrier islands and associated aquatic habitats (Cat Island archipelago), restoring littoral habitats, and protecting remaining wetlands
- Exotic species prevention
- Stewardship and sustainability which includes the Sustainable Green Bay Initiative
- Education and outreach
- Research and monitoring including the State of the Bay Report
- Public access enhancement

Fox River Remediation

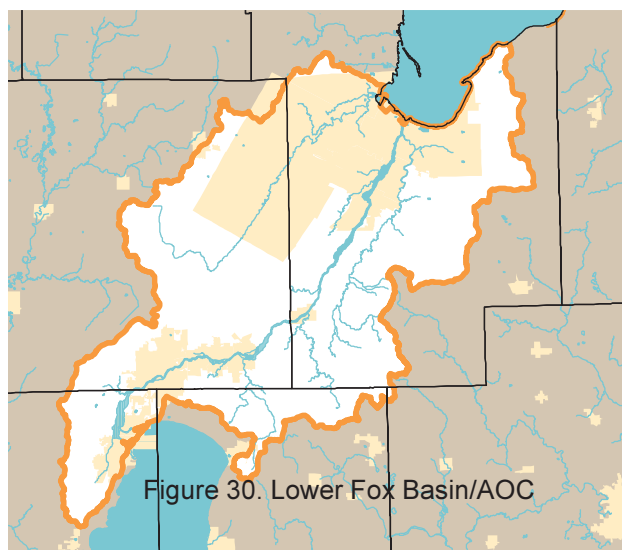
Since the last report to Congress, the remedial action effort on the Lower Fox River/Green Bay site has advanced from the “evaluation and planning stages” to the “remedial action phase”.

In 2002, DNR in cooperation with EPA, issued the Remedial Investigations Feasibility Study and Proposed Plan (“RI/FS”) for public comment. Following the receipt of significant public input, the agencies issued a segmented Record of Decision (ROD). In June, 2003, the ROD for Operable Units 1 and 2 -- the upper 26 miles of the Lower Fox River segment of this site -- was issued. The selected remedy for OU-1 directs that all sediment which is contaminated in excess of 1 ppm PCB or which cover sediments with this concentration be dredged, dewatered, and landfilled. The estimated volume of sediment which would be removed is 784,000 cubic yards.

The implementation step began in June 2003, with the signing of an “Administrative Order on Consent” (AOC) by USEPA Region 5, Wisconsin DNR, and one of the Primary Responsible Parties (PRPs) identified for the site. The AOC ordered the PRP to conduct necessary fieldwork and prepare the remedial design for OU-1. This step was followed immediately on June 30, 2003, with the issuance of the ROD for OU-3, OU-4 and OU-5. The remedy selected in this ROD is very similar to the first ROD and identifies all sediment over the PCB concentration of 1 ppm to be removed, dewatered and landfilled. Because of advances in design and costing information, this second ROD also identifies vitrification, a process which melts the sediment and destroys the PCBs, as an alternative treatment and disposal method to be considered during design. The ROD also identifies desposits at the lowest end of OU-2 and at the mouth of the river in OU-5 to be remediated, as well as the estimated 6.5 million cubic yards of in-river sediment in OU-3 and OU-4.

On October 1, 2003 a consent decree was filed in federal court committing WTM and the P.H. Glatfelter Company to fund implementation of the remedial action in OU-1. Following the public comment period, the consent decree was approved by the judge on April 12, 2004. Initial dredging will be done in Fall 2004, and full-scale remediation will begin in 2005. The remedial action is expected to take three to five years to complete. Food chain models predict that fish consumption advisories will begin to be relaxed within three years following completion of the remediation.

On March 5, 2004 an Administrative Order on Consent was finalized to accomplish the Remedial Design to implement the ROD for OU-2 through OU-5. Wisconsin DNR and USEPA Region 5 jointly



ordered Georgia Pacific and the NCR Corporation to develop this clean-up plan. The first step will be the collection of sediment characterization data. This data collection occurred summer 2004.

Sheboygan River and Harbor

The Sheboygan River Area of Concern includes the Sheboygan Harbor and 14 miles of the river up to the Sheboygan Falls Dam (Figure 31). The Sheboygan River, a tributary to Lake Michigan, was designated as a Superfund Site by U.S. EPA in 1985 because of PCB contaminated sediments. Tecumseh Products Company, Thomas Industries and Kohler Company have been identified as potentially responsible parties.

In May 2000, the Record of Decision for the Sheboygan River Superfund project was signed. About 4,300 cubic yards of contaminated sediment that had been previously dredged from the stretch of the Sheboygan River that runs from the area known as the "Upper River" and placed in steel storage facilities on the Tecumseh Products Company's Sheboygan Falls property, was shipped off site in September 2001. A consent decree was signed by U.S. EPA, U.S. DOJ and Tecumseh Products Company in 2003. This agreement requires Tecumseh to clean-up the upper portion of the Sheboygan River Superfund site including ground water at the Tecumseh facility, floodplain soil and river sediment. The Tecumseh facility clean-up is scheduled to proceed in 2004. River sediment characterization will be conducted in 2004 to complete a final remedial design for the floodplain and sediment clean-up. The river dredging and floodplain soil clean up phase is scheduled to begin in 2005.

WDNR staff is working with fellow trustees from U.S. Fish and Wildlife, and National Oceanic and Atmospheric Administration (NOAA) to determine the Natural Resources Damage Assessment for the restoration phase of the Sheboygan River Superfund Site. A sediment transport model was developed for the Sheboygan River Lower River and Inner Harbor reaches of the Superfund site to provide more information regarding the potential for scour of PCB contaminated sediment; this is an ongoing effort with EPA, ACOE and Baird.

Figure 31. Sheboygan Basin/AOC



C. Reiss Coal Peninsula on Lake Michigan and the Sheboygan River

DNR staff continues working closely with the City of Sheboygan and their consultants on the re-development of the former C. Reiss Coal Peninsula on Lake Michigan and the Sheboygan River. Elements include permitting for seawall re-construction on the Sheboygan River, remedial action plan for site cleanup, site grading permit, review of Lake Michigan revetment plans and a dune re-creation project. The city recently installed engineered stormwater devices to treat runoff from the newly developed areas on the peninsula. The city received a grant through DNR for a trail and fish cleaning station.

Other Basin Highlights

Dams

In the autumn of 2000, the Franklin Dam on the Sheboygan River was removed. The river is now free flowing in this reach and supports a more diverse fishery. For the last two years, DNR staff have been working with community members regarding the next dam downstream in Johnsonville. This dam on the Sheboygan River did not have an owner. Many local citizens are concerned about dam removal because they believe it prevents ice jams from forming downstream of their town. DNR is concerned this dam must be maintained or repaired, as it is a potential safety hazard. The Depart-

ment is attempting to locate an owner for the structure. Dam removal is an option that can be considered if no owner is found and citizen concerns can be addressed (ice jam study). Dam removal would also benefit fish and recreational uses of the river.

Volunteer and DNR Monitoring

There continues to be a strong volunteer monitoring effort in the Sheboygan area. DNR staff assist in the coordination and training of volunteers for both the "Testing the Waters" and "Water Action Volunteers" (WAV) groups. The former is an environmental educational program that involves area students from numerous local school districts. WAV is comprised of private citizens who volunteer to collect and analyze data to assess stream ecosystem health. Both groups continue to grow in capacity and technology for stream assessment. The Ellwood H. May Environmental Center of Sheboygan also continues to sponsor and assist with program activities for both groups. Several of the survey locations are within the AOC for the Sheboygan River.

Additional Activities, 2002-2004

- A canoe launch access site was constructed on the Sheboygan River along a county owned public trail. Another canoe launch is planned for the former Franklin Dam Impoundment on the Sheboygan River.
- WDNR assisted several municipalities and lake groups in determining techniques to control or reduce exotic species or nuisance levels of aquatic organisms (i.e. *Cladophora* sp., Eurasian water milfoil, elevated bacteria levels, etc.).
- WDNR helped fund Lake Michigan Beach Monitoring efforts by Sheboygan County through the use of a USEPA Beach Act grant.
- The *Broughton Sheboygan Marsh Strategic Management Plan 2001* was completed in 2001 and approved by the Sheboygan County Resources Committee in February 2002. This plan outlines mutually agreed upon responsibilities between the different units of government responsible for resource management throughout the marsh. A broad public process with representatives from local and county government, non-profit organizations, the WDNR and citizens at large were responsible for completing the plan. One key element to the plan was to have periodic complete drawdowns of the marsh to improve the biological diversity of the marsh and to stabilize cattails. A drawdown of the Sheboygan Marsh occurred in 2002. Sheboygan County and WDNR worked together to collect data during the drawdown including high quality color air photography before and after the drawdown. WDNR also worked with local conservation groups to establish a carp trap in the marsh. In early 2004, approximately 14 tons of carp were removed from the Sheboygan Marsh. WDNR is also pursuing an additional land purchase for the Sheboygan Marsh.
- Under Wisconsin's Source Water Assessment Program funded by USEPA as part of the Safe Drinking Act, assessments are completed for groundwater and surface water systems and include inventories of significant potential sources of contaminants to these system –ongoing;
- The Sheboygan County Land Conservation Department is working with WDNR and others on an update to the Sheboygan County Land and Water Management Plan. This plan is required by the State of Wisconsin for use of funds for the implementation of agricultural best management practices. The plan includes some joint strategies for implementing the state non-point pollution regulations. Priorities are being established for agricultural runoff practices near impaired waters and outstanding or exceptional waters in the county.
- In May 2003 WDNR staff conducted a stream monitoring workshop for the public that was concentrated on a small waterway named Willow Creek that is tributary to the Sheboygan River. The workshop included information on monitoring streams for habitat, water quality and biological community. This small stream supports a cool/cold water fishery including evidence of spawning by brook trout and coho salmon from Lake Michigan. The watershed is located in an area that will likely experience rapid urban development within the next decade.
- Sheboygan County Planning, UW-EX, and the Bay Lakes Regional Planning Commission continue to work with local units of government on comprehensive land use plans. WDNR assist these agencies with information for the natural resource elements of these plans. The county recently sent out a resident survey. In addition, they are developing a natural areas and critical

resource plan.

- WDNR issued municipal WPDES stormwater permits to the City of Sheboygan and the City of Sheboygan Falls in 2000. WDNR is also in the process of issuing WPDES permits for municipal storm sewer systems in the Town of Wilson, Town of Sheboygan and Village of Kohler. The permits require that these municipalities take action to improve the water quality of their storm water discharges.
- The Sheboygan River Basin Partnership is a consortium of local environmental and conservation groups, local business, local agency and government staff, and the public at large. The partnership is moving towards non-profit status and intends to raise funds that can be used to improve, restore or protect natural resources in the Sheboygan River Basin. The partnership has focused their resources on broad educational forums for residents in the Sheboygan area. In May 2003 they sponsored an educational forum on groundwater. In March 2004 they sponsored an educational forum on Lake Michigan bluff and dune erosion.
- The Sheboygan County Land Conservation Department continues to implement their stream buffer program for water quality improvement. Since the project began in 2000, the Land and Water Conservation Department has contracted with 40 landowners and installed more than 75 acres of buffer strips that reduce the amount of sediment and agricultural runoff from entering streams.

Onion River Stream Restoration Projects

The streams in the upper Onion River Watershed originate from numerous groundwater discharge points and have the ability to produce high quality water with temperatures suitable to support cold water species. Water quality in these cold headwater streams had declined since settlement because of agricultural operations, aquaculture (fish farming) and recreation. The Lakeshore Chapter of Trout Unlimited developed a strategic plan for restoration of the headwaters of the Onion River. The strategic plan encompasses both stream and watershed improvement combined with public acquisition. A number of stream and watershed restoration projects in the headwater areas of the Onion River Watershed are completed or underway to correct water quality problems and enhance habitat for fish and wildlife. Some of the actions that have occurred to date include:

- Removal of ponds and re-creation of natural, free flowing stream segments that are supported by springs.
- Relocation of an impacted 1,000 foot segment of the stream that was located adjacent to a farm operation and barnyard.
- Installation of in-stream fish habitat structures.
- Securing State funds (Targeted Runoff Management) for agricultural best management practices including manure storage.
- purchase 135 acres of land for public access and use

St. Louis River and Duluth Superior Harbor

The St. Louis River and Duluth-Superior Harbor area of concern includes 39 miles of the St. Louis River below Cloquet, Minnesota, the river estuary, Duluth-Superior Harbor and the lower Nemadji River. The area of concern straddles the Minnesota-Wisconsin border (Figure 32). Each state pursues implementation projects in their waters. The St. Louis River Citizens Action Committee, a local nonprofit organization that developed from the RAP citizens advisory committee, encourages implementation and facilitates coordination.

Stage 1 of the RAP, developed through a collaborative effort among the Minnesota Pollution Control Agency, the WDNR, and the Citizens Advisory Committee, identified nine of 14 beneficial uses as being impaired. Some impairments were associated with the physical loss and degradation of habitat, and with the loss of an estimated 7,700 of 12,000 acres of wetland and open water habitat in the estuary since settlement. Other problems were related more to pollution and toxicity. For years, the river smelled bad from industrial discharges. That changed in 1978, when the Western Lake Superior Sanitary District wastewater treatment plant began operation. Nevertheless, pollution continues to come from sources such as contaminated sediments, abandoned hazardous waste sites, poorly designed or leaky landfills, airborne deposition, industrial discharges, chemical spills, improperly sewered wastes and surface runoff.

Highlights

Contaminated sediments are an important priority in the AOC. Studies conducted by state and federal agencies in the late 1990s have provided a good understanding of the type, severity and location of contaminated sediments. These studies include work done at two Superfund sites on the Minnesota side. Recent accomplishments include the removal of

7500 cubic yards of PAH contaminated sediment and floodplain soils during the summer of 2003 from Newton Creek in the St. Louis River Area of Concern. Newton Creek flows through residential neighborhoods of Superior, WI into Hog Island Inlet of Superior Bay. Funding for this project was provided through the U.S. EPA Great Lakes National Program Office, Wisconsin Coastal Management Program, and the WDNR Harbors and Bays Remediation Program. WDNR is seeking funding to remediate contaminated sediment in Hog Island Inlet and restore this valuable shallow water and wetland habitat, which lies 1.5 miles from the confluence of the St. Louis River through Superior Bay to Lake Superior.

Currently, the St. Louis River Citizens Action Committee is facilitating updates to a contaminated sediment strategy focusing on PAH contamination in the Area of Concern with initial funding provided by the WDNR. Also, the Minnesota Pollution Control Agency has recently developed a GIS-based contaminated sediment database for the St. Louis River Area of Concern with funding from U.S. EPA GLNPO. Funding to complete this project on the Wisconsin side are also being pursued.

Mercury is a contaminant of particular concern in the St. Louis River. The St. Louis River Watershed TMDL Partnership will develop a total maximum daily load (TMDL) for mercury. The TMDL process is designed to improve impaired waters like the St. Louis River, where all facilities with discharge permits are operating within their permitted limits, but have pollutant levels exceeding state standards. This process will complement the mercury-reduction efforts that are already ongoing in the watershed.

Habitat restoration and protection are also important priorities. The Area of Concern has tremendous habitat value including several extensive Lake Superior coastal wetlands. The WDNR together with the state of Minnesota, federal, and tribal agencies worked with the St. Louis River Citizens Action Committee to develop the Lower St. Louis River Habitat Plan, published in May 2002. It provides detailed habitat maps and a consensus list of conservation and management objectives, targets and actions.

Public involvement and outreach have always been important components of this RAP. A host of partners are working together to improve the St. Louis River. These include the U.S. EPA, Minnesota Pollution Control Agency, Minnesota DNR, WDNR, local and tribal governments, Minnesota and Wisconsin universities and Sea Grant Programs, the St. Louis River Citizens Action Committee, River Watch Project, River Quest, Harbor Technical Advisory Committee, U.S. Army Corps of Engineers and numerous private businesses and individuals.



Figure 32. St. Louis & Duluth/Superior AOC

Exotic Species

WDNR has an active role in the development of strategies to research, monitor, and control nuisance (exotic) aquatic species in Wisconsin's waterways. The WDNR in partnership with the University of Wisconsin Sea Grant Institute and UW Extension, and through the assistance of volunteers have developed a monitoring program.

Beyond reporting and tracking the presence of some of the more troublesome exotic species, the DNR actively participates in projects to study their effects on the ecosystem as well as develop strategies for their control. Wisconsin has developed a Comprehensive State Management Plan to

deal with this issue. The plan, developed in response to the National Invasive Species Act of 1996, provides the framework for a comprehensive state program to address the problems caused by invasive nuisance species. The scope of the activities are broad and aimed at preventing new introductions, controlling the spread of existing populations, and implementing abatement strategies to safeguard public health and the environment.

Specific initiatives involving exotics include development of ballast water management practices and standards, development of a rapid response initiative, a dispersal barrier project, and control of intentional introductions. These initiatives are designed to keep exotics from entering the Great Lakes ecosystem.

Chapter 6: Wetlands

In December 2000, the Wisconsin Department of Natural Resources Wetland Team developed *Reversing the Loss – A Strategy for Protecting and Restoring Wetlands in Wisconsin*. The Strategy charts a course for current and future Department policies and programs involved in wetland education, protection, restoration, enhancement and management. It established four major goals and performance measures to accomplish those goals by the year 2007. We are in the middle of implementing the Strategy and have made substantial progress in meeting some of the performance measures, however, there are also limitations to accomplishing others. Progress over the last two years on those goals and performance measures is described below:

“Reversing the Loss” – the Wetland Strategy

Goal 1 Strengthen relationships with property owners, nonprofit conservation organizations and local governments

Over 75 percent of the state's wetlands (over 4 million acres) are in private ownership. The department will need to enlist wetland owners, nonprofit conservation organizations and local governments in preserving and restoring wetlands on private property while sustaining agriculture, forestry, recreation and other wetland uses including development when compatible with wetland health. An established dialogue with wetland owners, and focused outreach, education and incentives along with technical assistance, will be necessary components to make this strategy work.

Goal 1 Performance Measure: Public Outreach

Wetland Restoration Handbook for Wisconsin Landowners, 2nd Edition

The second edition of the Wetland Restoration Handbook for Wisconsin Landowners has recently been published by the DNR's Bureau of Integrated Science Services. The handbook is a collaboration between the DNR and the Wisconsin Wetlands Association, a nonprofit organization. The handbook describes the fundamentals of wetland restoration in an interesting way. New chapters that have been added since the first edition include seeding and planting considerations, invasive species control information, wetland management recommendations, additional photographs and enhanced graphics. There is an expanded reference section of useful internet web sites, flora and fauna guides and a new statewide contact list.

Restoration workshops

Wisconsin Wetlands Association and Wisconsin Waterfowl Association held wetland restoration workshops with assistance from a US Fish and Wildlife Service grant in collaboration with DNR. These workshops were geared toward landowners and land managers interested in restoring their own wetlands.

Wetlands Internet Web Site

DNR continues to update the Wetlands web page as new information of interest becomes available. Some of the most significant changes include the addition of a Wetlands Mitigation page and

Assessment and Monitoring page. Also, our What's New page updates the public on recent events, laws and new publications. The DNR's Wetland Web address is: <http://dnr.wi.gov/org/water/fhp/wetlands/index.shtml>.

Guidance and Policy

The Wetland Team continues to develop guidance and policy, as necessary. Administrative codes have been developed to establish standards for compensatory mitigation and to simplify the approval process for wetland conservation activities.

Wetland Restoration, Management and Protection

DNR staff continue to work with the public and other government agency staff to provide technical assistance on wetland restoration, management and protection.

Wetland Educational Publications

Informational materials both for the general public and focused on a selected group have been developed and are being distributed. Examples include *Midwestern Ephemeral Wetlands*, *A Vanishing Habitat* and *Guidelines for Wetland Compensatory Mitigation In Wisconsin*. There has been a great demand for these informational publications.

Regulatory Workshops

A conference was held with local road advocates and key stakeholder groups to discuss streamlining the regulatory process for those projects. Meetings have been held with various energy industry groups to develop methods and techniques for wetland avoidance and minimization of impacts from energy projects.

Training Sessions

Wetland delineation, ecological assessment and plant identification training conducted by DNR staff and an interagency group is a continuing process. Training for both the public (consultants and individuals) and agency staff are offered. Two Regulatory IV sessions were held for agency staff. Trainers included WDNR, Southeastern Wisconsin Regional Planning Agency, US Geological Survey, US Army Corps of Engineers and Natural Resources Conservation Service staff.

Wetland Compensatory Mitigation Workshop

The Department sought and received an USEPA grant to cover costs associated with a web-site and several powerpoint presentations. A full-day workshop for over 70 consultants involved in wetland regulatory work and wetland mitigation was held in April 2003. With limited Department staffing for the program, we felt it was key to provide very detailed training to the consultants that handle this type of work. Since April, the quality of submittals has improved noticeably.

In addition, Department staff have sought and taken many opportunities to present information at existing industry group forums over the last two years including three different Wisconsin Realtors Association events, the Milwaukee Builders Association, the Milwaukee Bar Association, the League of Municipalities, meetings of consulting engineers groups, and the Solid Waste Technical Advisory committee.

Incentives

The Department has developed a landowner's guide to property assessment, provided information and testimony to the state Legislature on "use value assessment" legislation which has passed and resulted in wetlands to be taxed at 50% of assessed value. We are currently developing a guide explaining the legislation and how it will impact the landscape and a report on other state and province tax policy and incentive programs which will include a recommendation for a Wisconsin program.

Goal 2: Manage wetlands to protect diversity of species, wildlife health, and ecological integrity

Wetlands are naturally productive and interspersed among our state's aquatic and terrestrial

communities. Because protecting, restoring and enhancing wetlands contributes significantly to the ecological health of other biological communities, wetland communities should be a focus when managing Wisconsin's biodiversity. Wildlife that depends on water — everything from water fleas to mink to osprey — require adequate habitat and protection from ecosystem contaminants. Establishing a system of connected aquatic and terrestrial features for each eco-region will help target resources and activities on areas with the highest ecological potential. Acquiring exceptionally high quality or scarce wetland communities such as calcareous fens and floodplain forests, and managing them to preserve a diversity of species are key aspects of this strategy.

Goal 2 Performance Measure: Monitoring and Assessment

Development of Wetland Assessment Methods: Level 1, 2, 3 Approach

The Wetland Team is developing a wetland assessment and monitoring program following the general Level 1, 2, 3 approach endorsed by the USEPA Workgroup. This approach is designed to maximize efficient use of scarce resources for wetland monitoring while gathering scientifically valid information that addresses the needs of managers. Level 1 is Landscape Assessment relying on coarse, landscape scale inventory information, typically gathered through remote sensing and preferably stored in, or convertible to, a geographic information system (GIS) format. Level 2 is Rapid Assessment at the specific wetland site scale, using relatively simple, rapid protocols. Level 2 assessment protocols are to be validated by and calibrated to Level 3 assessments. Level 3 is

Intensive Site Assessment using intensive ecological evaluation methodologies, particularly research-derived, multi-metric indices of biological integrity. The Department's strategy is to develop complementary wetland condition assessment tools that can be used across the broad spectrum of wetland types at both the site-specific and landscape scales. Publications describing the methods we have developed are available on the Wetland Assessment and Monitoring web page at:

<http://dnr.wi.gov/org/water/fhp/wetlands/assessment>.

Level 3 Site Intensive Methods: Wisconsin Floristic Quality Assessment

The Department has adapted the Floristic Quality Assessment methodology for use in Wisconsin plant communities. The final report to EPA, *Development of a Floristic Quality Assessment Methodology for Wisconsin*, published in June 2003, describes the method, its uses and limitations. This method allows for an intensive, expert-based, assessment of the "Floral Diversity" function of a given wetland site. It can also be used to document the biological condition of the wetland, based on its plant

community. The method relies on a "coefficient of conservatism" pre-assigned by a group of botanical experts to each native species. The coefficient is assigned on a scale of 0-10, based on the species' likelihood of occurring in an undisturbed plant community.

The method is applied by gathering a complete plant inventory and applying the coefficients to each species occurring on the site. A mean coefficient of conservatism and a floristic quality index can then be calculated for the site. The method requires a high degree of plant identification skill to correctly inventory the site. A computer program to enter plant inventory data and calculate WFQA statistics is now available.

Multi-metric Indices of Biological Integrity for Depressional Wetlands

In 2002, refinement of the depressional wetland biotic index to assess additional metrics was completed. The results are published in *Refinement and Expansion of Wetland Biological Indices for Wisconsin*. Five separate indices were successfully developed that can separate impacted wetlands

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from least-impacted reference sites. The successful indices were for plants, macroinvertebrates, diatoms, and amphibians. These metrics can be combined into a composite Index of Ecological Integrity, or applied separately.

Staff training and field testing of the original multi-metric biotic index for depressional wetlands (based on plants and macroinvertebrates) was held in 2002. The final report (2004) will assess the feasibility of implementing this method by existing staff on a routine basis.

Level 1 Landscape Level Method: Using Landsat Imagery to Map Invasive Reed Canary Grass (Phalaris arundinacea): A Landscape Level Wetland Monitoring Methodology

The Department has developed a protocol for mapping the most widespread invasive wetland plant using Landsat satellite imagery. This will provide a coarse-level, first-cut assessment of wetland condition at a landscape scale. The protocol was successful in mapping wetlands heavily dominated by reed canary grass to a ½ acre minimum mapping unit with satisfactory accuracy in a large pilot area (182 km by 182 km) in southern Wisconsin. The final report to USEPA discusses ways of using this data to report on this aspect of wetland condition by watershed. The resulting classification is in GIS format and can be used for a variety of planning and management purposes. The map is being made available on the Department's wetland assessment and monitoring webpage at <http://dnr.wi.gov/org/water/fhp/wetlands/assessment>.

Integrating Wetlands into the Watershed Approach – Milwaukee Basin Wetlands Assessment

In November of 2001, a two-phase pilot project in the Milwaukee River Basin was started with the goal of developing a process to assess wetland functions on a watershed scale. The project is intended to provide managers and planners with information to set priorities for wetland protection and restoration. The six watersheds of the Milwaukee River Basin have been further subdivided into 58 subwatersheds, allowing for analysis on a variety of scales. This project concentrates on developing Level 1 GIS-based decision support tools to aid planning for wetland protection and restoration. In the coming second phase of the project our existing Level 2 rapid assessment tool will be modified to serve as a check on the results of the decision support tools. We will also develop an assessment method to evaluate the restorability of degraded and former wetlands.

Project staff are utilizing existing GIS information to develop custom data layers for use in the Basin. New data layers have been created to map drainage ditches and wetlands dominated by reed canary grass. A map of potentially restorable wetlands has been produced using soils, wetland inventory and land use data to identify restoration opportunities. The Department is contracting with county land conservation and planning agencies in 2004 and 2005 to intensively ground-truth the potentially restorable wetlands map in selected subwatersheds and further assess the restorability of sites identified on the map. Department staff will ground-truth a stratified random sample of the potentially restorable wetlands that have been mapped across the entire basin.

Expert-derived GIS-based decision tools are used to assess at a coarse level the relative benefits of various restoration opportunities and the relative degree to which existing wetlands provide wildlife habitat, protect water quality in downstream waters and provide water storage to stabilize water flows in the watershed. These tools will be applied by the county cooperators to develop restoration and protection plans for several focus subwatersheds. Site assessment protocols will be developed and implemented by Department and cooperator staff at a select sample of sites to verify the results of the GIS-based assessments and refine the analysis with site level data. County cooperators will report to the Department on the feasibility of using the GIS tools for planning purposes.

Goal 2 Performance Measure: Restoration and Acquisition

Wetland Reserve Program

The Wetland Reserve Program is a voluntary program offering landowners the opportunity to protect, restore, and enhance wetlands on their property. The USDA Natural Resources Conservation Service (NRCS) provides technical and financial support to help landowners with their wetland restoration efforts. The NRCS goal is to achieve the greatest wetland functions and values, along with optimum wildlife habitat, on every acre enrolled in the program. This program offers landowners an opportunity to establish long-term conservation and wildlife practices and protection. DNR staff

continue to provide assistance to NRCS staff and the public to facilitate implementation of this important wetland program. 4,733 acres of wetlands were restored through the Wetland Reserve Program in 2003 and 8,349 acres were restored in 2004.

WDNR Lake and River Protection Grants

Lake and river grants paid to restore, enhance and acquire wetlands. Three projects received grants solely to restore and enhance wetlands. Wetlands were enhanced through shoreland restoration and land acquisition projects for seventeen other projects.

Goal 3: Streamline DNR regulatory approach for permits and restoration activities in wetlands

Because Wisconsin's regulatory and enforcement program for wetlands is based primarily upon federal laws and regulations, several state and federal agencies are typically involved in every permitting decision. That system often leads to inefficient, inconsistent decision-making, which frustrates wetland owners and doesn't sufficiently protect wetlands. The department can improve the process by identifying and removing barriers to efficient and effective decision-making. The department can also eliminate duplication and provide consistency by establishing a state wetland protection program that supersedes federal regulation and oversight. New legislation authorizing compensatory mitigation and providing state enforcement authority is a necessary part of this regulatory approach. The department can encourage local officials and development interests to avoid wetlands or incorporate them into their project as a site amenity, reducing the need for wetland permits.

Goal 3 Performance Measure: Regulation

A rule to expedite the review and approval for wetland restoration projects went into effect in 2003. To facilitate wetland conservation projects, this new administrative code establishes a streamlined process to review regulated activities associated with the restoration of former wetlands, the enhancement of degraded wetlands and the maintenance or management of existing wetlands.

Wetland Compensatory Mitigation

Rules establishing standards for development, monitoring and long term maintenance of wetland compensatory mitigation projects that are approved by the Department and to establish procedures and standards for the establishment and maintenance of mitigation banks went into effect in 2003. With two years experience with the new program rules, it appears the changes are working as intended. Furthermore, the WDNR and US Army Corps of Engineers, US Environmental Protection Agency and US Fish and Wildlife Service entered into a memorandum of agreement that formally adopts the DNR's guidance document to make decisions between agencies consistent across the state.

Initial results indicate that the wetland compensatory mitigation program has not resulted in any increased review times for wetlands. Also, permitted wetland losses have not increased since the implementation of this new program.

Goal 4: Develop and use modern technology to map, monitor, protect and manage wetlands

Giving the public and staff a common up-to-date source of wetland information to use in making decisions is essential for the preceding strategies to succeed. An integral component of wetland information is the Wisconsin Wetland Inventory, which consists of over 1,700 maps showing the location and types of wetlands in Wisconsin. The cycle for updating inventory information is currently 24 years due to staff shortages and needs to be shortened to make it more useful. Making the wetland inventory available for planning and managing wetlands, in addition to its current use in regulating wetlands, as well as developing a unified tracking and reporting system, are crucial to the success of this strategy.

Much progress has been made and will continue to be made developing new strategies for

wetland monitoring due to support through the US EPA's State Development Grant Program. New assessment methodologies are described under Reversing the Loss Goal 2.

Goal 4 Performance Measure: Wisconsin Wetland Inventory

The Wisconsin Wetland Inventory continues to improve its new methodology for creating digital orthophotography (aerial photos without distortion). The goal is to eventually have complete state-wide seamless coverage available for downloading from the Internet. In 2004 USEPA funded a digital mapping process for a watershed wetland assessment project in the Lower Chippewa Basin.

*Volunteer Monitoring of Purple Loosestrife (*Lythrum salicaria*) Infestations and Biological Control Effectiveness.* A survey protocol has been developed and baseline monitoring has been conducted at *Galerucella* beetle release sites to monitor the effectiveness of the beetles in reducing purple loosestrife populations and documenting the response of native vegetation. The Department has funded a purple loosestrife outreach and management liaison who coordinates education and technical assistance in all aspects of the biocontrol project to teachers, organizations and interested citizens. The coordinator works with the Wisconsin Wetlands Association to offer workshops teaching volunteers to map infestation sites. Follow-up workshops are offered to train volunteers to rear and release beetles and monitor vegetation at release sites. These surveys were conducted in 2002 and 2003. Locational data on infestations are entered into a GIS developed and maintained by the Great Lakes Indian Fish and Wildlife Commission (GLIFWC).

Frog and Toad Survey

The *Wisconsin Frog and Toad Survey* is an on-going survey coordinated by the WDNR. The survey was initiated in 1984 and relies heavily on volunteer efforts. Background information on the survey is included in Mossman and Hine (1985), and the history, analytical techniques, distribution maps, and trend results through 1995 are thoroughly summarized in Mossman, et al. (1998). Survey routes are distributed statewide, with a goal of two survey routes in each county. Routes consist of 10 sites that are monitored 3 times annually. Presence/absence of each species is determined for each site based on the breeding calls of male frogs. The relative number of calling individuals at each site ranks the abundance of each species. Survey data are statistically analyzed and a calling index to the route populations is calculated. These route populations are regressed over years to create a species population trend (Dhuey and Hay 1999). While the results cannot be used to monitor the quality of wetlands, it does provide long-term trend data on anuran species over time.



Chapter 7: Public Health/Aquatic Life Concerns

The potential presence of toxic substances in surface water, groundwater and drinking water is a concern for individuals, businesses and governments. As more is understood about known and potential effects of individual contaminants — as well as suspected synergistic effects of multiple contaminants — the public is demanding to know more about environmental or ambient water quality and quality of water at the tap.

Federal and state requirements address these concerns, in part, through — for example — reporting requirements for communities on the vulnerability of drinking water systems to potential contaminant sources under the state's drinking water program or through protection afforded surface waters through the state's stringent provisions regulating the calculation of effluent limits for toxic substances found in NR106.

Major topical areas in this section include water quality assessments detailing the presence of and resulting impairments from toxic substances; aquatic life toxicity testing; fish consumption advisories, fish kill data, sediment contamination sites, reports of beach closings, incidents of waterborne disease and assessments of surface waters for drinking water use designation.

Water Quality Assessments - Toxic Substances

Table 10 below reports waters monitored for toxic substances and those with elevated levels of toxicants as of 2002. Streams are reported in Part III, Chapter 3. In 2002, of the 24,422 miles monitored or evaluated, 1,138 miles of rivers were partially or not supporting their designated uses due to elevated levels of toxic substances in the water column, fish tissue, or discharges.

The entire length of Wisconsin Great Lakes shoreline miles (1,017) are considered to have elevated levels of certain toxic contaminants. Pollutant sources to the Great Lakes are many, including airborne pollutants like mercury, sediments contaminated from historic discharges or activities, tributaries carrying toxic runoff, and wastewater discharges.

Table 10. Total Size of All Waterbodies Affected by Toxicants

Waterbody	Size monitored for toxicants*	Size with elevated levels of toxicants
River (miles)		1138.25 (1)/ (2)
Lakes (acres)		
Great Lakes (miles)	1017	1017 (3)

(1) From USEPA database includes waterbodies monitored and evaluated

(2) Stream miles under fish consumption advisories

(3) Based on fish consumption advisories

Aquatic Life Toxicity Testing

In toxicity tests, aquatic organisms are exposed to samples (effluent, sediment, ambient waters) for a specific time period, and then are compared to a control treatment (e.g., an exposure of the test organisms to dilution water with no effluent added) to determine whether toxicity is present at levels of concern to the environment. There are two types of WET tests - acute and chronic. The objective of an acute test is to determine the concentration of test material that produces a harmful effect (usually mortality) during a short term exposure under controlled conditions. Chronic tests are used to predict the concentrations that interfere with normal growth, development, and reproductive potential of aquatic organisms. During a chronic test several life stages (or the entire life cycle) of the organism are continuously exposed to the test material.

University of Wisconsin-Madison's State Laboratory of Hygiene

The WDNR works cooperatively with UW-Madison's State Laboratory of Hygiene (SLH) to main-

tain a biomonitoring laboratory. The SLH maintains cultures of several fresh water species and is capable of performing acute and chronic toxicity tests on effluent, ambient waters, and sediment samples collected statewide. The laboratory also provides sample collection services for these and other tests. SLH staff have participated on WDNR policy teams dedicated to the development of new and improved toxicity testing methodologies. Additionally, WDNR and SLH staff assess the applicability of alternative toxicological assessment methods to other WDNR watershed management programs.

Each year, the SLH accepts requests for toxicity testing from WDNR basin engineers and permits staff. WDNR staff select facilities to be tested by the laboratory in order to collect data for compliance inspections, permit reissuances, and enforcement situations. The tests completed in 2002-2003 are summarized below (see Table 11).

Table 11. Summary Of SLH Toxicity Test Results For 2002-03

Sample type	#of acute	Results		#of chronic	Results	
		Pass	Fail		Pass	Fail
WPDES Industrial & Industrial	33	33	0	33	20	13
WPDES WDNR-owned fish hatcheries	7	7	0	7	7	0
Totals	40	40	0	40	27	13

NA = not applicable

Acute and chronic WET tests performed by the SLH on municipal and industrial wastewaters made up the majority of toxicity tests conducted in 2002 and 2003. While the majority of wastewater effluent samples were non-toxic, 13 of 33 (39%) of the chronic tests performed by the SLH during 2002-2003 indicated the presence of chronic toxicity at levels of concern. Because most SLH tests are a result of WDNR staff selecting facilities that have suspected toxicity problems (except for WDNR-owned fish hatcheries, where SLH testing is required by WPDES permits), it is not surprising that a large number of chronic tests at these facilities failed. Additional data collected by the SLH in these situations is often used in permitting and enforcement situations to help staff make better-informed decisions. In many of these cases, the cause(s) of toxicity is not determined by the SLH during these tests, but the permittee is required to address the situation. Additional testing and/or toxicity identification is often required in subsequent WPDES permits, to further characterize the potential for significant effluent toxicity from these facilities.

The SLH also applied acute and chronic toxicity testing techniques to other sample types. WDNR's sediment management program continues to benefit from the ability of laboratory staff to conduct sediment toxicity tests. Acute and chronic toxicity tests using *C. dubia*, a midge larvae (*Chironomus tentans*) and an amphipod (*Hyalella azteca*) were performed in 2002 and 2003.

Stormwater runoff and receiving water samples from areas near the Milwaukee airport were analyzed for toxicity in order to determine the potential of deicing chemicals to impact nearby surface waters. Surface water samples from around the state were tested to assess the potential for acute and chronic toxicity in lakes and rivers at those sites. Individual chemicals were also tested at the lab in order to provide toxicological data to assist the Department in developing water quality criteria. Other testing at the lab in 2002-2003 included tests to:

- to assess the cause of fish kills and in emergency spill situations;
- to determine the potential impacts to surface waters from landfill leachates;
- to investigate the sensitivity of early life stages of burbot and northern pike, in support of WDNR efforts to develop water quality standards for ammonia; and
- to determine whether endocrine disrupting compounds were present in source water, drinking water, and wastewater effluent samples.

WDNR/SLH efforts in the next biennium will continue to emphasize monitoring for WPDES-

permitted facilities. Efforts will also be made to generate additional sediment and ambient data and to supplement the toxicological database for water quality criteria, where needed.

Table 12. Whole Effluent Toxicity (WET) Test Results
Calendar Years 2002-03

Acute			Chronic		
Results	Number Tests		Results	Number Tests	
	Pass	Fail		Pass	Fail
506	483	23	469	416	53

WPDES Permit-Required Toxicity Testing

All surface water dischargers with a WPDES permit are evaluated by WDNR staff to determine their potential for acute and chronic toxicity at the time of permit reissuance. If it is determined that a significant potential for effluent toxicity is present, individual permits require that acute and/or chronic whole effluent toxicity (WET) monitoring be performed during the permit term. The need for WET testing is evaluated using data regarding available dilution, industry type, type and number of industrial contributors to municipal treatment plants, detection of chemical-specific compounds, additive use, and other factors. WET tests completed for WPDES permit compliance during calendar years 2002 and 2003 are summarized below (see Table 12).

Whole Effluent Toxicity (WET) Test Results

During 2002-2003, a total of 975 WET tests (506 acute, 469 chronic) were completed by permittees and submitted to the Department as required by their WPDES permit. Of these tests, 23/506 (4.5%) acute tests and 53/469 (11%) chronic tests exhibited toxicity at levels of concern. In those cases where repeated or severe toxicity was noted, facilities are required to perform follow up testing, toxicity identification evaluations in an attempt to identify the source(s) of toxicity, and they may get WET limitations in subsequent WPDES permits.

The WDNR will continue to implement its WET program in the next biennium, including an emphasis on additional WET monitoring and toxicity problem resolution for WPDES-permitted facilities.

Fish Tissue Monitoring Program

During calendar years 2002-2003, over 1800 fish samples were collected as a part of the fish contaminant monitoring program (Table 13 below (April 2004)). This includes fish samples that were collected as a part of the normal fish contaminant monitoring program, samples collected by cooperators, and samples collected under special projects and research.

In 2002-2003, samples were collected from approximately 137 lake locations, 36 sites in flowing waters, and 19 areas of Lakes Michigan and Superior (preliminary data as of April 2004).

Each year WDNR collects and analyzes samples of fish tissue from Wisconsin's inland waters and the Great Lakes, including their tributary streams. The objectives of the fish contaminant program includes protection of fish consumers by determining the levels of bioaccumulatory contaminants in the edible portions of fish and compare these levels to health guidelines as determined by the Wisconsin Division of Health.

Samples from the Great Lakes were analyzed for PCBs, pesticides, and mercury, while samples

from river systems were primarily analyzed for PCBs and mercury. Fish samples from inland lakes were analyzed almost exclusively for mercury.

Fish consumption advisories are issued for certain species and sizes of fish from given areas where the concentrations of chemicals in the fish flesh exceed the health advisory levels. Fish contaminant data is also used to make natural resource and environmental management decisions.

Fish Consumption Advisories

Wisconsin issues general advice that applies to most inland waters where other pollutants or where mercury concentrations do not require more stringent advice. The general statewide advisory is based on US EPA's reference doses for mercury and typical levels of mercury found in Wisconsin fish based on the mercury concentration data that Wisconsin amassed over the last 20 years.

In addition to the statewide advisory that applies to most inland waters, more stringent consumption advice applies where fish have been found to contain higher concentrations of mercury or PCBs and other pollutants. The 2003 update of the Wisconsin Fish Consumption Advisory lists fish from 50 of the more than 2,000 lakes, river segments, and border waters tested (Table 14) due to the presence of PCBs and other organic chemicals. The number of surface water segments with PCB-based advisories has remained fairly constant since 1990. The 2003 update of the Wisconsin fish consumption advice lists fish from 93 specific surface waters due to higher concentration of mercury. See Table 14 for a list of health criteria used for Wisconsin's advisories

Table 13. Wisconsin's Fish Contaminant Monitoring and Cumulative Advisories

Year	Sites Sampled**	Samples Collected**	TOTAL Reaches or Waters w/Advisories PCB/Mercury
Prior to 1980	233	3,003	7/0
1980-1989	978	11,139	22/161
1990-1999	770	11,565	58/322
2000-2001	209	1,824	59/331
statewide mercury advisory adopted			
2002	110*	997*	50/92
2003	96*	881*	50/93
Total	1,634*	29,409*	

* Total number not yet available, based on data available as of April 2004. (Total cumulative number of sites does not include duplicate visits to a site.) ** includes samples collected and/or analyzed by cooperators

Table 14. Wisconsin Fish Consumption Advisory Guidelines

Contaminant	Population	Concentration	Advice
PCB¹	All	< 0.05 ppm	Unlimited Consumption
		0.05 – 0.2 ppm	1 meal/week or 52 meals/year
		0.2 – 1.0 ppm	1 meal/month or 12 meals/year
		1.0 – 1.9 ppm	6 meals/year
		> 1.9 ppm	Do Not Eat
Mercury	Sensitive Group ²	< 0.05 ppm	Unlimited Consumption
		0.05 – 0.22 ppm	1 meal/week or 52 meals/year
		0.22 – 1.0 ppm	1 meal/month or 12 meals/year
		> 1.0 ppm	Do Not Eat
	General Group ²	<0.16 ppm	Unlimited Consumption
		>0.16 ppm	1 meal/week or 52 meals/year
Dioxin³	All	< 10 ppt	No Advice Given
		> 10 ppt	No one should eat
Chlordane	All	< 0.16 ppm	No advice given
		0.16 - 0.65 ppm	1 meal/week or 52 meals/year
		0.66-2.82 ppm	1 meal/month or 12 meals/year
		2.83-5.62 ppm	6 meals/year
		> 5.62 ppm	No one should eat

1. Although this advice is based on reproductive health effects, the same advice is given for women, children, and men to protect against other potential health effects such as immune suppression and cancer

2. Sensitive group includes pregnant women, women of childbearing age, and children under age 15. General Group includes women beyond childbearing age and men.

3. Sum of total dioxin equivalence expressed as 2,3,7,8 TCDD based on dioxin and furan congeners and EPA human health TEFs.

Sites of known sediment contamination

The table below lists selected sediment sites; the status column level of management. The full table of contaminated sediments can be found at dnr.gov.wi/org/wm/wqs/sediment.html

Table 15: Sites of Known Sediment Contamination

PROJECT NAME - RP Name	Basin & WATERBODY	Status* *	CURRENT & PROJECTED STATUS FY 2002-2003	CONTAMINANT
Appleton MGP - WE Energies	Lower Fox River GMU - Fox River	5,6	Initial site assessment completed; coal tar found in the river and removed in August 2002. Coal tar in River, on bank and all unsaturated soils (2 acres) excavated summer 2003. Coal tar on bedrock - few to no sediments. In-situ stabilization of saturated soils on site in progress. Anticipated ISS completion is July 31, 2004. Thermally treated soils will be mixed with organics and returned to site. Post-remediation monitoring is planned.	PAH, BTEX, CYANIDE, STYRENE
Fond du lac River - no RP	Upper Fox R. GMU - Fond du Lac River	2	Initial sediment sampling indicated potential high levels of metals and a potential coal gas site impact. Toxicity samples collected in fall of 2000. Impacts were noted but no specific RP to go after. Water program will need to assess the need for any work in the river, then come to RR for assistance.	METALS
Fond du lac MGP - Alliant Energy	Upper Fox R. GMU - Fond du Lac River	3	Sediments investigated and ecological study completed, low impact PAHs. DNR sent NFA letter for seds to Alliant Energy on 10-10-1996. Nad portion of clean-up still ongoing (groundwater pump and treatment)	PAHS, BTEX CYANIDE
Green Bay MGP - WPS	Upper Fox R. GMU - Fox River	2	Initial sediment assessment completed. Evaluate need for additional investigation before proceeding with a remedy.	PAHS, BTEX CYANIDE
Hayton Millpond - Tecumseh	Lakeshore GMU - Pine & Jordan Creeks, & ditches; Hayton Millpond	4,5	Site investigations complete, and FS completed. Discussions for remedy are taking place. Initial source removal completed in OU-1 in 2001. OU-1 (segments 1 through 6) removal completed in fall 2001, OU-1 segment 7 and OU-2 (workplan in progress).	PCB'S
Hewitt Machines - Neenah Redevelopment Authority (John Bergstrom)	Lower Fox River GMU - Fox River	1	Sediment sampled, needs further investigation. Waited for final ROD from EPA. This area will not be addressed under Fox River cleanup plan and needs to be addressed by RP.	PCBs
Kewaunee Marsh - Wis. Central Railroad, DNR state lead	Lake Shore GMU Kewaunee River	4	Interim remediation measures implemented. Phase II of SI/FS underway. Funding for additional monitoring sought via GLNPO grant. Grant awarded 2003-2005 doing continued monitoring and arsenic speciation at this time. Recently submitted second grant for treatability studies.	ARSENIC

Restrictions on Bathing Areas

The 2003 beach season earmarked the implementation of the first comprehensive beach-monitoring program in the State of Wisconsin. Beach Water Quality Standards staff at the Wisconsin Department of Natural Resources secured grant funding from U.S. EPA for the development of a comprehensive beach-monitoring program. This effort is being directed at Great Lakes coastal waters, namely Lake Michigan and Lake Superior. The purpose of the program is to monitor selected beaches along the Great Lakes in accordance with the Beaches Environmental Assessment & Coastal Health (BEACH) Act requirements. The program also allows for prompt notification to the public whenever bacterial levels exceed EPA's established criteria and establishes a beach monitoring and public notification plan that assists communities along the lake shore to improve their ability to monitor and notify beach users of risks associated with high bacteria levels.

In March 2001 the Department solicited the assistance of local health department officials and interested parties and formed a 12 member BEACH Act Workgroup. The goal of the Workgroup was to assist the Department in developing a consistently implemented beach monitoring and public notification program. The program was developed in accordance with EPA published guidance and performance criteria and involved the following:

- Identifying all public beaches along Lake Michigan and Lake Superior
- Evaluating and classifying each beach as "high", "medium" or "low" priority.
- Developing a monitoring scheme for each priority category
- Standardizing testing and sampling methods
- Developing methods to notify the public of health risks
- Developing methods to notify EPA
- Allowing for public input

For the purpose of the BEACH Act, a beach was defined as:

"A publicly owned shoreline or land area, not contained in a man-made structure, located on the shore of Lake Michigan or Lake Superior, that is used for swimming, recreational bathing or other water contact recreational activity."

A total of 173 public beaches along Lakes Michigan and Superior were identified as staff literally walked the coast to geo-locate each beach via the use of GPS and GIS technologies. County maps locating each beach were developed indicating the adjacent coastal recreation waters, points of access by the public, length of beach, as well as any known potential sources of pollution.

In addition to collecting GIS data, a survey was designed to assess the effectiveness of current notification procedures, and to identify our audience. Field staff also recorded the type of terrain within 5 miles of the beach, number of point source discharges, any known point and non-point sources of pollution, land use (farms, animals, houses, marinas, industry, restrooms, parking lots), and beach populations (bathers in/out of water, waterfowl, sand sports, water sports).

In December 2002 and January 2003, public meetings were held at locations around the state to present the BEACH Act Workgroup's proposals and solicit questions and comments from the public. Public comment was very instrumental in the beach ranking and public notification decisions.

With the help of guidance provided by EPA, the Workgroup designed a tiered monitoring plan for beaches in each of the priority categories. The general monitoring plan includes the following:

- Monitoring for all beaches will begin one week prior to the swim season
- Samples shall be collected from the middle of the typical bathing area or for longer beaches one sample shall be collected for every 500 meters of beach.
- Samples shall be collected where 24 to 30 inch depth is first encountered and taken 6 to 12 inches below the surface of the water.
- Additional samples shall be collected whenever there is a heavy rainfall, a known pollution event where the potential exists for fecal contamination and immediately following an exceedance of the water quality criteria.

More specifically, high priority beaches will be monitored at a minimum of 5 days each week, medium priority beaches will be monitored at least twice weekly and low priority beaches will be

monitored once weekly or on a case-by-case basis.

A goal of the Wisconsin beach program is to produce a comprehensive communication process that will best inform the public about beach water health risks and water quality issues in general. Information obtained from the Social Survey and the public meetings was used to help determine the best methods to notify the public. Several products were developed for the Wisconsin program. A standard format for statewide beach advisory, beach closure, and beach open signs was developed. The signs were distributed to all beaches involved in the monitoring program. The same signs will be used consistently among all the beaches along the Great Lakes. Signs were developed in three languages: English, Spanish, and Hmong.

An informational brochure was developed to distribute to the public. The brochure addresses concerns expressed by survey respondents. The brochures describe in detail the circumstances under which advisories will be posted and removed and under which a beach will be closed and re-opened.

Wisconsin has partnered with USGS and the Southeast Beach Task Force to develop the Great Lakes Beach Health Website. Funds from the BEACH Act grant was used to enhance the existing Southeast Wisconsin Beach Health website that is administered by the USGS in conjunction with the Milwaukee Health Department. The public will have access to real time data and advisory information for all beaches monitored along the Great Lakes borders. The DNR website itself will feature a page about beach water quality, public health and the BEACH Act.

www.wibeaches.com

Water Quality Standards for Bacteria

Water quality standards define a relationship between the amount of bacteria in the water and the potential risk to human health. Swimming in water with bacteria concentrations that are in compliance with the standard will not eliminate the risk of illness, but the risk of disease due to exposure is decreased.

USEPA-established guidelines were derived from studies conducted in the 1970's and 1980's. In 1986 USEPA recommended that *E. coli* and/or *Enterococci* be used as an indicator of fecal contamination. The USEPA standard was set at a geometric mean of 126 colonies per 100 milliliters (mL) for *E. coli* in freshwater systems and 33 colonies per 100 mL for *Enterococci* in marine systems. These numbers are correlated with an illness rate of 8 individuals per 1,000 swimmers. Wisconsin's water quality standards are currently expressed as a fecal coliform standard. The Clean Water Act, as amended by the BEACH Act, requires Wisconsin to adopt new or revised water quality standards for pathogens and pathogen indicators for which USEPA has published criteria. Wisconsin has convened a Bacteria Standards Technical Advisory Committee and is in the process of adopting EPA's new criteria for *E. coli* and revising the applicable disinfection policy.

Economic Impacts of Beach Pollution

According to a report by the Natural Resources Defense Council, at least a third of all Americans visit coastal and Great Lake counties and their beaches annually. Recreational water tourism, attributable in part to clean beaches, generates substantial revenues for state and local governments. Polluted beaches not only cost local economies tourist dollars and jobs, but they also cause a loss to those who had planned to visit the beach and swim in the water. Economists estimate that a typical swimming day is worth \$30.84 to each individual. Depending on the number of potential visitors to a beach, this "consumer-surplus" loss can be quite significant.

Addressing the sources of pollution so that beach water does not pose a health risk is the optimal solution that will take significant time and money. In the meantime however, it makes sense from a public health perspective to monitor beach water and advise beach users of health risks associated with elevated bacteria levels at contaminated beaches. Such advisories, if used effectively, can provide beach-specific information that will discourage beach users from swimming and running the risk of getting sick. Given the large number of people using beaches, as well as the substantial income from recreational water tourism, the cost of establishing a beach-monitoring program is reasonable and will be supported.

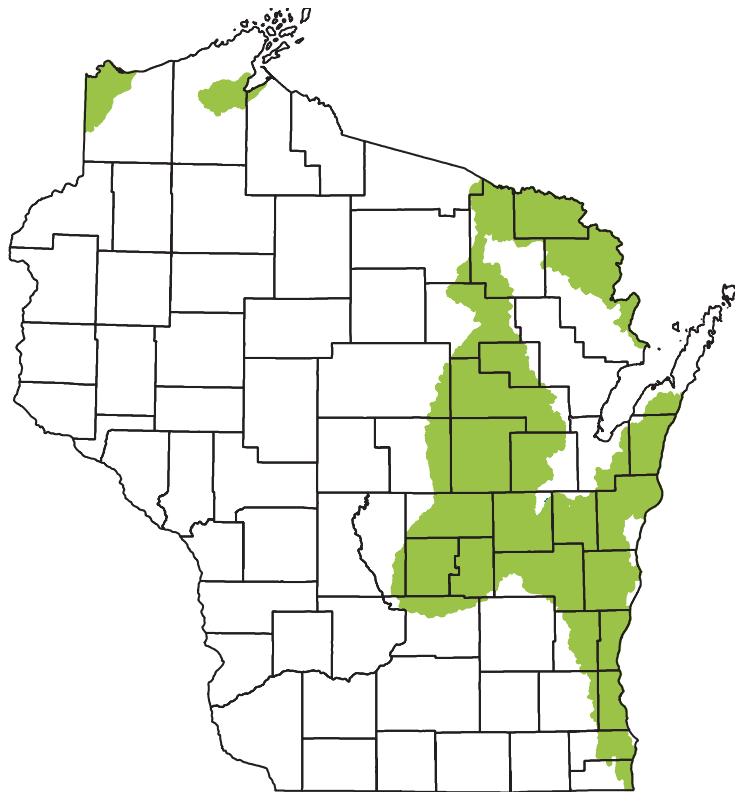
Source Water Assessment Program

The 1996 Amendments to the Safe Drinking Water Act require states to have an USEPA-approved Source Water Assessment Program (SWAP). The purpose of the program is to protect public health by providing information that can be used to prevent contamination of public water supplies. Other benefits include: preserving water resources for future generations; avoiding the expense of cleaning up a contaminated water supply or finding alternative sources of water; reducing system costs by providing the information needed to apply for a waiver from specific monitoring requirements; and encouraging economic growth by assuring an abundant supply of clean water.

In 2004, Wisconsin is in its fifth year of implementing the Source Water Assessment Program (SWAP). Assessments for each public water supply include: 1) delineation of source water area boundaries; 2) inventory of significant potential sources of contamination within those boundaries; 3) determination of susceptibility for each system; and 4) release of the assessment results to the public water supplier and to the public. Assessments must be completed for both groundwater and surface water systems.

Source water assessments for drinking water systems using surface water are nearly complete. These systems provide drinking water to 1.5 million people in communities along Lakes Michigan, Superior and Winnebago. Surface water source water areas are shown below. Source water assessments for drinking water systems using groundwater are in various stages of completion. Municipal systems were targeted to be completed by the end of 2003 and remaining public water systems will be assessed by the end of 2004.

Figure 33. Surface Water Source Water Protection Areas developed through the Source Water Assessment Program under the Safe Drinking Water Act.



Chapter 8: Ground Water

Groundwater

The WDNR has statutory authority to protect, maintain, and improve groundwater within the state. WDNR establishes the groundwater quality standards for the state, monitors groundwater quality, identifies and addresses groundwater quality problems and makes recommendations for preventing contamination. The Groundwater Section within WDNR's Bureau of Drinking Water and Groundwater takes a leading role in these activities. The Groundwater Section also works closely with the Groundwater Coordinating Council (GCC) to insure coordination between state agencies with groundwater protection responsibilities.

Wisconsin's Groundwater Law

Wisconsin recently enacted a Groundwater Quantity Management Law that will allow the WDNR to issue permits for high capacity wells. The law is considered a "first step" toward managing Wisconsin's groundwater quantity. Initially, the following steps will be taken to implement the law:

- Owners of new wells will notify the DNR of the well's location and pay a fee prior to construction;
- DNR will complete a limited number of well applications for wells in sensitive areas;
- Reporting requirements for high capacity wells will be expanded;
- Private well construction surveillance and inspection will be expanded by 2%; and
- A groundwater advisory committee will be established. The Groundwater Quantity Committee will be made up of representatives from government, private industry, agriculture, environmental interests and municipal water purveyors.

Two groundwater management areas are identified in the new legislation: the Fox River Valley and Southeastern Wisconsin. Groundwater levels in these two areas have declined significantly in the past 50 years.

Wisconsin's groundwater quality is protected under Act 410, which is the basis for Wisconsin's legal, organizational and financial capacity for controlling groundwater pollution. Under Act 410, Wisconsin developed Chapter 160 Wisconsin Statutes. Under Chapter 160, Wis. Stats., the WDNR must establish state groundwater quality standards based on recommendations from the Department of Health and Family Services (DHFS). Setting standards is a continuous process. As substances are determined to be a threat to groundwater or if they are detected in groundwater, they are placed on a priority list established by WDNR in conjunctions with other state agencies. The numerical standards are in chapter 140, Wis. Adm. code. For each substance there is an enforcement standard (ES) which determines when a violation has occurred and a preventive action limit (PAL) which serves as a trigger for possible early remedial actions.

Once groundwater standards are set, all state agencies must manage their regulatory programs to comply. Each state agency involved in activities that affect groundwater must promulgate rules to assure that the groundwater standards are met and to require appropriated responses when standards are not met. The role of each agency in implementing the groundwater standards is described below under "Wisconsin Groundwater Programs."

The Groundwater Coordinating Council

The responsibility for managing Wisconsin's groundwater is delegated to many different government agencies. The Groundwater Coordinating Council (GCC) facilitates cooperation between the different agencies on non-regulatory issues. Since 1984, The GCC has served as a model for interagency cooperation among state government official, the governor, and local and federal governments. The WDNR chairs this council.

Senior-level representatives from the departments of Natural Resources; Commerce; Agriculture, Trade and Consumer Protection; Health and Family Services; Transportation; the University of

Wisconsin System; Wisconsin Geological and Natural History Survey and governor's office serve on the council. The GCC advises and assists state agencies in the coordination of nonregulatory programs and the exchange of information related to groundwater.

Department of Natural Resources

The WDNR is the designated state agency to protect, maintain and improve groundwater within the state. The Bureau of Drinking Water and Groundwater regulates public water systems and private drinking water supply wells. The groundwater section assists in coordinating groundwater activities of the WDNR as well as other state agencies. The groundwater section has primary responsibility for adoption of groundwater standards contained in chapter NR 140, Wis. Adm. code. Other duties of the Groundwater Section include: development of the annual groundwater monitoring plan; coordination of the joint solicitation for groundwater related monitoring and research proposals; review and management of groundwater monitoring projects; integration of groundwater in basin reports and watershed plans; the Source Water Assessment and Wellhead Protection Programs, and maintenance of a data management system for groundwater data.

Source Water Assessment Program

The 1996 Amendments to the Safe Drinking Water Act require states to have an USEPA-approved Source Water Assessment Program (SWAP). The purpose of the program is to protect public health by providing information that can be used to prevent contamination of public water supplies. Other benefits include: preserving water resources for future generations; avoiding the expense of cleaning up a contaminated water supply or finding alternative sources of water; reducing system costs by providing the information needed to apply for a waiver from specific monitoring requirements; and encouraging economic growth by assuring an abundant supply of clean water.

Wisconsin is currently in its fifth year in implementing its SWAP. Assessments for each public water supply include: 1) delineation of source water area boundaries; 2) inventory of significant potential sources of contamination within those boundaries; 3) determination of susceptibility for each system; and 4) release of the assessment results to the public water supplier and to the public. Assessments must be completed for both groundwater and surface water systems. Wisconsin has until December 30, 2004 to complete all source water assessments.

Source water assessments for the drinking water systems using surface water have been completed and are available on the Internet at: <http://www.WDNR.state.wi.us/org/water/dwg/swap/index.htm>. These systems provide drinking water to 1.5 million people in communities along Lakes Michigan, Superior and Winnebago. Surface water source water areas are shown below. Source water assessments for drinking water systems using groundwater are in various stages of completion. Assessments for municipal systems were completed in 2003 and are being hand-delivered to system operators. All public water supply system assessments will be completed in 2004. Brief summaries of all the completed assessments can be found at the Internet address above.

The Bureau of Waste Management regulates and monitors groundwater at proposed and active solid waste facilities and landfills. The Bureau for Remediation and Redevelopment oversees clean-up actions at spills, hazardous substance release sites, abandoned container site, state funded responses, Brownfields, "high priority" leaking underground storage tanks, closed wastewater and solid waste facilities, dry cleaner sites, hazardous waste corrective action and generator closures and sediment clean-up actions. The program runs the Dry Cleaner Reimbursement program and helps turn the Brownfield Site Assessment Grant program. Remediation and Redevelopment is also responsible for the Geographic Information System (GIS) registry of closed Remediation sites. This database is available on the Internet and includes information on site location and remaining residual groundwater contamination above the NR 140 ES. Department of Natural Resources Manual Code 4822.1 instructs staff on coordination of groundwater contamination investigations and regulated monitoring of potable wells.

The Bureau of Watershed Management regulates the discharge of municipal and industrial wastewater, by-product solids and sludge disposal from wastewater treatment systems and wastewater land treatment/disposal systems. The Bureau also issues WPDES permits for discharges

associated with clean-up sites, regulated under the authority of the Bureau for Remediation and Redevelopment. The Bureau has primary responsibility for regulating stormwater and agricultural runoff as well as managing waste from large animal feeding operations.

Department of Agriculture, Trade and Consumer Protection

The Department of Agriculture, Trade and Consumer Protection (DATCP) manages pesticides and pesticide practices to assure that established groundwater standards for these contaminants are not exceeded. This may include prohibition of certain activities including pesticide use. The agency also manages practices to “minimize” groundwater contamination to the extent “technically and economically feasible.” DATCP regulates storage, handling, use and disposal of pesticides and the storage of bulk quantities of fertilizer. DATCP is also responsible for coordinating the development of Wisconsin’s “generic” and “pesticide specific” state pesticide management plans for protection groundwater from pesticides.

In 1993 the Agricultural Chemical Cleanup Program (ACCP) was established to address point sources of pesticide contamination the ACCP reimburses responsible parties for cleanup costs related to pesticide and fertilizer contamination at facilities and in nearby wells. The ACCP also funds DATCP oversight of pesticide and fertilizer cleanup activities.

The Land and Water Resource management program provides funding primarily to counties to assist in protection of groundwater resources. Some of this funding is dedicated to the development and implementation of improved nutrient and pest management practices.

DATCP funds the Agricultural Clean Sweep program which helps farmers dispose of unwanted pesticides, farm chemical and empty pesticide containers.

Department of Commerce

The Department of Commerce enforces private on-site wastewater treatment system rules and the plumbing code. The Department is also responsible for regulating storage tanks containing flammable, combustible liquid and hazardous substances. Since 1991 the data base inventory of petroleum product tanks regulated by Commerce has increased from 143,681 to 174,725. Commerce is responsible for the Petroleum Environmental Cleanup Fund Act (PECFA) which cleanup at leaking underground storage tank sites. Since its inception, PECFA has reimbursed petroleum storage tank system owners approximately \$1.05 billion to remediate petroleum contamination in soil and groundwater. Commerce and WDNR administer the Brownfields Sites Assessment Grant program for property owners.

Department of Health and Family Services

Chapter 160, Wis. Stats., directs the Department of Health and Family Services (DHFS) to recommend health-based enforcement standards for substances found in groundwater. DHFS staff provide information on health risks posed by drinking water contaminants, and investigate suspected cases of water-borne illness. The agency has been active in determining the extent, health effects and providing information to the public on naturally occurring arsenic in Winnebago, Shawano, Outagamie and Brown Counties.

Wisconsin Geological and Natural History Survey

The Wisconsin Geological and Natural History Survey (WGNHS) performs basic and applied groundwater research and provides technical assistance, maps and other information and education to aid in management of groundwater resources. The WGNHS groundwater program is complemented by geology and soils programs that provide maps and research based information essential to the understanding of groundwater recharge, occurrence, quality and movement.

Department of Transportation

The Department of Transportation (DOT) regulates the storage of highway salt to prevent groundwater contamination by dissolved chloride. DOT is also responsible for potable well sampling at 29 rest areas and 113 waysides. Other DOT groundwater related activities include road salt

research, hazardous material and waste investigation or remediation, wetland compensation and research, and stormwater management and research.

University of Wisconsin System

The University of Wisconsin system (UWS) has research, teaching and information/education responsibilities. These three missions are integrated through cooperation and joint appointments of teaching, research and extension personnel who work on groundwater issues.

Wisconsin's Groundwater Monitoring Program

Wisconsin is drafting a new statewide groundwater monitoring strategy. Representatives from the WDNR, DATCP, USGS, WGNHS and the Academy of Arts, Letters and Sciences looked at existing monitoring programs and monitoring needs that still need to be met. The objective of the new monitoring strategy is to coordinate groundwater monitoring between all state agencies that regulate groundwater to get a complete picture of groundwater quality and quantity in the state. The statewide groundwater monitoring strategy will meet the prerequisites of the Clean Water Act Section 106(e)(1) as described in the EPA's "Elements of a State Water Monitoring and Assessment Programs" guidance document. Specific goals include:

- Documenting status and trends in groundwater quality, quantity and use;
- Improving of understanding of groundwater systems and groundwater/surface water interactions; and
- Improving communication of groundwater information to citizens, policy makers and resource managers.

The components of the groundwater monitoring strategy include:

- A summary of existing groundwater monitoring data to better identify what data is currently available and where gaps in our knowledge are;
- A fixed network of monitoring locations to be used by all agencies to answer groundwater quality and quantity questions;
- Groundwater quality sampling data in areas of concern;
- Stream flow monitoring stations in areas important to groundwater systems;
- Water use reporting data to improve optimization of groundwater resources;
- Data management mechanism; and
- Informational materials to communicate the state of groundwater in Wisconsin to citizens.

As funding becomes available to implement the components of the strategy, they will be integrated into WDNR's yearly monitoring plan. The GCC will take the lead role in data management while other agencies will continue to make improvements in their monitoring efforts based on the comprehensive strategy. The components of the strategy may change over time according to needs of the different agencies. The requirements of Chapter 160, Wis. Stats., will continue to be met under the strategy.

Groundwater Quality

Groundwater quality varies greatly throughout Wisconsin. Human-made contaminants of concern are Volatile Organic Chemicals (VOCs), nitrates, and pesticides. Iron, manganese, sulfate, arsenic and radium are naturally occurring groundwater contaminants that present health concerns and are present in Wisconsin groundwater. Microbial contaminants including viruses, bacteria, and parasites are also a concern. To address specific concerns the GCC selects research projects as part of joint solicitation process. DNR funded projects are listed below.

Nitrates

Nitrate-nitrogen is the most commonly found groundwater contaminant in Wisconsin. Of 10,112 private wells sampled in the state since 1991, 20 % exceeded the ES and 50% exceeded the PAL. The majority of these wells are located in agricultural areas. Arsenic

Naturally occurring arsenic in Wisconsin groundwater has become an important issue since it was

first detected in 1987. The problem is especially prevalent in Outagamie, Shawano, Winnebago and Brown counties. In 2001, well sampling occurred in 15 townships in these counties. This data has not been evaluated yet, however, in two of the townships, almost 50% of the samples exceeded 5 ppb while 21.8% exceeded 10 ppb. In 2000, 3,300 public water supply systems were sampled for arsenic. Results show that 80 of these exceeded the proposed 10 ppb standard.

Radioactive Compounds

Two studies have been initiated by the WDNR to evaluate radioactive compounds in groundwater. In 2000, WDNR staff collected samples from 100 community and nontransient noncommunity public water supply wells which will be analyzed for total Uranium alpha activity, total Thorium alpha activity, Radium 226 and Polonium 210 alpha activities. Preliminary results indicate total Uranium is the major contributor to high gross alpha activities. A second study is looking at radon in drinking water supplies. WDNR staff will sample 340 noncommunity, nontransient and other than municipal water systems per year. Project results will determine the impact of new EPA standards for radon in drinking water. Preliminary results tend to support earlier findings that indicate approximately 50% of public water systems monitored in Wisconsin exceed the proposed radon standard of 300 pCi/L.

Joint Solicitation Projects

Continuing Projects:

Arsenic Contamination in Southeast Wisconsin: Sources of Arsenic and Mechanisms of Arsenic Release Jean Bahr and Madeline Gotkowitz, University of Wisconsin - Madison and Wisconsin Geological and Natural History Survey, Project #174.

New Projects:

Monitoring and predictive modeling of subdivision impacts on groundwater in Wisconsin Ken Bradbury and Jean Bahr, University of Wisconsin-Extension, Geological and Natural History Survey and Jean Bahr, University of Wisconsin - Madison, Project #178.

Field and Laboratory Validation of Photoactivated Adsorption for Removal of Arsenic in Groundwaters M. Anderson, University of Wisconsin-Madison, Project #179.

Development of a groundwater flow model for the Mukwonago River watershed, southeastern Wisconsin Jean Bahr, University of Wisconsin - Madison, Project #180.

Groundwater Pollutant Transfer and Export in Northern Mississippi Loess Hills Watersheds George Kraft and Bryant Browne, University of Wisconsin - Stevens Point, Project #181.

Future Groundwater Protection

Below are some of the priorities set by the Groundwater Coordinating Council for 2004.

- Investigation of adverse impacts from groundwater withdrawals: In FY 97, DNR staff with help from the Groundwater Quantity Technical Advisory Committee, completed a report on the groundwater quantity issue (see "Condition of the Resource - Groundwater Quantity" for the Executive Summary of this report). In the report, localized areas with groundwater quantity problems are identified and the effects of groundwater withdrawals on surface waters and long-term groundwater availability are discussed. There is a need to further quantify hydrographic relationships of surface and groundwater. The GCC should continue to encourage research efforts that will provide information useful in addressing this issue.
- Investigation of recently discovered groundwater contaminants: Recent research conducted in Europe and the U.S. indicates that traces of pharmaceuticals (including antibiotics and hormones) and pesticide breakdown products are common contaminants found in groundwater and surface water. Current testing methods do not allow adequate detection of these possible contaminants. Research is needed to determine whether these substances pose a threat to Wisconsin's groundwater resource. There is also a need to evaluate the sources, fate, transport, and chemistry of p-

Isopropylbenzene (cumene), aluminum, molybdenum and strontium (non-radioactive form) in groundwater; evaluate existing databases; and sample at-risk potable wells for these contaminants.

- Investigation of naturally occurring substances in groundwater: Continued problems of elevated arsenic, low pH, and other water quality problems in domestic wells exist over large areas of northeast Wisconsin. DNR needs more information about the extent and causes of these problems in order to give advice to homeowners and well drilling contractors. Additionally elevated sulfate and total dissolved solids have been found in some new deep municipal wells in the Lower Fox River Valley making the wells unusable. In some other existing deep wells as far south as Milwaukee the total dissolved solids have been steadily increasing over the years. These sulfate and TDS levels pose a problem for local water managers, and the origin of the dissolved solids is not completely understood.
- Provide resources to local governments for Smart Growth/Comprehensive Planning activities. Recent legislation has required local units of government to develop a comprehensive plan by 2010 in order to undertake land use activities. This plan must address 9 elements, including natural and agricultural resources, housing, utilities, and land use. This planning process presents a unique opportunity to address and implement groundwater protection at the local level. The GCC will seek ways to assist local communities in their planning efforts to encourage groundwater protection.
- Promote consistency between the agencies on data management issues: Through updates to the DNR's groundwater data system and the Directory of Groundwater Databases, state and local government agencies now have more convenient access to groundwater data. This effort must be maintained by continuing to identify what data needs exist and ways to make data easily accessible. Data consistency must be promoted by use of translatable geolocational coordinate systems and consistent data elements for use in a GIS environment. The GCC will continue to provide leadership and communication on data management through its subcommittees. This continued effort displays the GCC's commitment to management of the resource through sound scientific methods.
- To act as a coordinating and facilitating mechanism for the publication and distribution of information and educational materials on groundwater related issues: The public has benefited from the consistent educational messages that have been endorsed by the Education Subcommittee. The Education Subcommittee will continue to provide its leadership and assistance to state agencies providing educational materials to the public. Priorities for the future include promoting water stewardship, awareness of water quantity issues, and providing materials for local communities to assist in their comprehensive planning activities.
- Distribution of findings from groundwater research or monitoring projects: There has been considerable progress in preparing summaries of the results of groundwater-related monitoring and research projects funded through the joint solicitation process. More than 90 of these summaries are now available on the UW-WRI web site maintained by UW-WRI. The rate of response to the web site posting of research findings has been very encouraging so far. To maintain and enhance this response it will be important to add new summaries annually as they become available, create a more visually appealing set of front-end pages for the site, and publicize the web site location and content more widely. More work needs to be done to target interested audiences and distribute summaries and final reports more widely.
- Identify tools that can be used to better predict Wisconsin's groundwater susceptibility to contamination: Studies have demonstrated the need for developing statewide data layers that would facilitate better groundwater vulnerability assessments. These data layers include land use, soils, regional groundwater flow, hydrogeologic characteristics such as aquifer materials, and potential point sources of contamination such as underground storage tanks and pesticide spills. The

studies also illustrate the importance of locational data for contaminant sources. The GCC's Planning & Mapping and Monitoring & Data Management Subcommittees have prioritized, promoted, and helped facilitate the development of data layers as part of a larger data integration initiative.

- Research on land use management and its impact on the groundwater resource: Additional research is needed on the effect of various land uses (e.g. urbanization) on groundwater quality and quantity. Several projects that study the impacts of land use on groundwater have been and continue to be funded through the joint solicitation. These projects must be managed in such a way as to maximize their relevance to state land use problems. This issue crosses agency lines and promises to be an important issue for years to come.
- Continued evaluation of alternatives to onsite sewage systems: Although the DNR and Commerce have funded monitoring projects in this area, additional work is needed to find state-of-the-art private sewage system technologies that provide efficient, cost-effective options and protect groundwater resources.
- Investigation of the causes and effects of nitrate in groundwater: The GCC will support the agencies and the UWS in obtaining information pertinent to the human health implications of consuming nitrate contaminated groundwater and the effect of discharge of this groundwater on surface waters and their ecosystems. In addition, it will continue to facilitate consistent education to provide a clear message on the many causes and effects of nitrate in groundwater for urban and rural citizens.
- Solutions to groundwater nonpoint pollution problems: A 1997 DATCP report indicates that 8.5% of Wisconsin's wells still contain detectable atrazine residues. In addition, 10% exceed the nitrate standard. These rates are substantially higher in agricultural areas. Agriculture is the major source of these pollutants. More work is needed to determine how far Wisconsin groundwater will deteriorate without a substantial change in farming practices, and what practices will sustain both agriculture and groundwater quality.
- Improved communication between local and state government: The Local Government Subcommittee to the GCC was created in February 1993 to provide a line of communication between local and state governmental entities. To increase the responsiveness of state agencies to local government needs, local government needs must be communicated to the GCC and relayed to the appropriate agencies. An effort must be made by the GCC to increase interest in the GCC by local governments, and to offer opportunities to communicate concerns to regulatory agencies.